MARCH

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Relationship of Oral Conditions to Conditions Elsewhere—*Barker*

Obturators—*Schuiringa*

Fixed Appliances—*Ferris*

Wax and Investing—*Morris*

Cementing Inlays—*Gates*

Dentistry in Great Britain—*Matheson and Payne*

Removable Bridgework—*Doxtater*

Treatment Appliances—*Grieve*

Symposium: Etiologic Factors in Periodontal Lesions—*Spalding, Johnson, MacMillan, Hartzell, Tishler and Williams*

Transplantation—*Stein*

Fixed Appliances—*McCoy*

EDITORIALS

Hospitalization for Dental Operations

"The Good Old Times"

DENTAL HEALTH EDUCATION

Dietetics Applied to Oral Health

CONTENTS

Charles Lane, D.D.S., Vice President of the American Dental Association.....Frontispiece

ORIGINAL COMMUNICATIONS

Growth of Knowledge Regarding the Relationship of Oral Conditions to Conditions Elsewhere in the Body.
By Lewellys F. Barker, M.D. 403

A New System of Fixation of Obturators.
By J. G. Schuiringa 412

Recent Advances in Fixed Appliances.
By Henry C. Ferris, D.D.S. 423

Wax and Investing.
By L. B. Morris, D.D.S. 428

Cementing Inlays.
By M. A. Gates, D.D.S. 435

The History of Dentistry in Great Britain.
By Leonard Matheson and J. Lewin Payne 441

The Formation of the Pocket: Diffuse Atrophy of Alveolar Bone.
By Bernhard Gottlieb 462

Questionable Methods in the Practice of Crown and Bridge Work.
By Vincenzo Guerini, D.D.S. 476

The Relation of Balancing the Occlusion to Other Steps in the Construction of Removable Bridgework.
By L. W. Doxtater, D.D.S. 482

The Value of Fixed Attachments in Treatment Appliances.
By George W. Grieve, D.D.S. 496

Oral Sepsis.
By Grace Rogers Spalding, D.D.S., F.A.A.P. 504

Occlusion An Etiologic Factor in Periodontal Lesions.
By A. LeRoy Johnson, D.M.D. 507

Nonuse in the Development and Resistance of the Alveolar Process.
By Hugh W. MacMillan, D.D.S., M.D., F.A.C.D. 511

Bacteria.
By Thomas Bradford Hartzell, M.D., D.M.D., F.A.C.D. 516

The Possible Etiologic Relationship of Diet to Periodontal Lesions.
By Benjamin Tishler, D.M.D. 519

Diabetic Periodontoclasia.
By John Bell Williams, Ph.G., D.D.S. 523

Annual Report of the Dental Educational Council of America.
By Albert L. Midgley, D.M.D., Sc.D. 530

Studies in Transplantation.
By Dr. Georg Stein 541

Operative Procedures in Periodontia Surgical Treatment.
By Justin D. Towner, D.D.S. 551

The Practical Simplification of Fixed Appliances.
By James David McCoy, M.S., D.D.S., F.A.C.D. 556

EDITORIAL DEPARTMENT

Hospitalization for Dental Operations 564
"The Good Old Times" 566
Truman W. Brophy (1848-1928) 570

BUREAU OF DENTAL HEALTH EDUCATION

Dietetics Applied to Oral Health 573
The Preparation and Delivery of a Speech.
By Bertram G. Nelson 583
Mouth Hygiene in Hawaii.
By Helen M. Baukin 590
Field Notes 591

NEWS DEPARTMENT

Medical and Dental News 592

ANNOUNCEMENTS

Calendar of Meetings. (National, State, State Examining Boards.)—Alabama Dental Association.—Louisiana State Dental Society.—New Jersey State Dental Society.—Tennessee State Dental Association.—Kentucky State Dental Association.—South Dakota State Dental Society.—North Dakota State Dental Society.—Wisconsin State Dental Society.—Wyoming State Dental Association.—American Dental Assistants Association.—Southern Academy of Periodontology.—The State Board of Registration and Examination in Dentistry of New Jersey.—American Dental Hygienists Association.—Southwestern Society of Orthodontists.—St. Louis Study Club of Dentistry Clinic and Dinner.—Position for Dental Intern.—The Morris L. Chaim and the Benjamin Lord Prize for 1927.—Resolution. 594-598

ADVERTISING DEPARTMENT

Index to Advertisements A-61
Classified Section A-54, A-55

CHARLES LANE, D.D.S., Detroit, Michigan
Vice President of the American Dental Association

UNIV. OF MICH.

THE JOURNAL
OF THE
American Dental Association

VOL. 15 MARCH, 1928 No. 3

Original Communications

GROWTH OF KNOWLEDGE REGARDING THE RELATIONSHIP OF ORAL CONDITIONS TO CONDITIONS ELSEWHERE IN THE BODY*

By LEWELLYS F. BARKER, M.D., Baltimore, Maryland

KNOWLEDGE of medicine and of the medical specialties never stands still; it is ever undergoing expansion and modification. Though the rate of growth may vary considerably at different times and is by no means evenly distributed throughout all domains, knowledge in each division is always becoming enlarged, erroneous conceptions are being dispelled and partial truths are being winnowed of their false components. One of the great joys of professional life consists in watching the advent of new facts and principles that applications of the method of science compel, a joy that is second only to that experienced by the original investigators themselves.

In the domain of dental medicine, there have been really great advances in our time. Let any dentist or any physician of middle life look back to the time when he began his studies and contrast the state of knowledge and practice existent then with the conditions of today. If such progress could be made in a single generation, what may we not expect in the years just ahead? For every new discovery is an impetus to further investigation; the body of truth in its movement grows, in volume, like an avalanche.

*Read before the Chicago Dental Society, Oct. 18, 1927.

Regarding the advances in the technic of operative and of prosthetic dentistry, marvelous as they have been, you who practice dentistry are far better informed than any general medical practitioner can be. But medical men, and particularly internists, have been greatly intrigued by the growth in the correlations that have, in recent years, been established between dental and gingival conditions on the one hand and conditions elsewhere in the body on the other. It is of a few of the more interesting of these correlationships that I beg leave to remind you in my remarks tonight. We now know much of the ways in which diseases and anomalies in dental domains may damage other parts of the body more or less distant from the mouth, and, in turn, we are gradually becoming better informed regarding the chain of events through which extra-oral diseases or anomalies can influence conditions in the teeth and in the tissues immediately adjacent to them. As I refer briefly to some of the more important of these two sets of influences, I may take occasion to point out opportunities for near-term fruitful investigation, in the hope that such "tips" may spur some of the younger members of this society who are susceptible to heuristic suggestions to undertake corresponding original inquiries.

DAMAGE TO DISTANT PARTS DUE TO PERIODONTAL AND GINGIVAL INFECTIONS

It would seem almost trite to discuss again before this audience the significance of focal infections in the mouth and particularly in the gums and about the apices of teeth as regards the origin of inflammatory and degenerative processes in other parts of the body. For was it not in this very city of Chicago, through the initiative of the internist Frank Billings, and the pathologist Ludvig Hektoen, and through the researches of the group of eager medical and dental investigators whom they stimulated that a large part of our present knowledge of this subject, so important both for medicine and dentistry, came into being? And yet it must be confessed that neither the medical profession as a whole nor the dental profession as a whole has fully grasped either the problem of causal relationships of focal to distant injuries or the significance of the attempts made to cure or ameliorate the distant damaging processes by attacks made on the primary local infections. Though the better informed and the more skilful men in both professions are now actively and cordially cooperating in order that their patients may profit by the newer knowledge, there are, unfortunately, still many men in both professions who, through ignorance of the facts and principles or through negligence in promptly making application of them, allow persons who, in the earlier stages of metastatic infections or intoxications, might have been saved from serious injuries to drift on into permanent crippling and hopeless invalidism. It is too bad. Undoubtedly, much arthritis, myositis, neuritis, nephritis, endocarditis, myocardial degeneration and iritis could be cured, or better still avoided altogether, if the primary infections and intoxications to which they are secondary could be early recog-

nized and promptly overcome. Among the primary infections that may be responsible, those of the gums and about the teeth are, as everyone now knows, among the more important. The physician seeking the cause of metastatic infections and intoxications dare not today neglect to investigate, or to have investigated for him, the conditions that exist within the mouth. Not that all metastatic infections could be prevented, even if the knowledge we possess were to be systematically applied. Nor can we promise in any given instance that the removal of focal infections will surely lead to the cure of metastatic infections that have already developed. It requires only a little experience with subacute and chronic infectious arthritis, for example, to convince one of the limitations of our powers of prophylactic intervention on the one hand and of curative therapy on the other. In some instances, very much indeed can be accomplished; in others, despite the most careful diagnostic investigations and the best considered treatment, the results obtained are far from satisfactory either to the patients or to their physicians. What we know and what we can do still weigh light in the scale as compared with what we wish to know and what we desire to do. But that we are limited in our knowledge and in our powers is no excuse for failing to make use of what we do know, for neglecting to do what can, with some prospect of success, be done. Diligence in keeping pace with the progress of knowledge and bravery and enthusiasm in applying new knowledge to the welfare of patients are primal duties of both dentists and physicians. In daily practice, there is no place for the Laodicean, the man who is neither cold nor hot but lukewarm, either because of paucity of convictions or because of apathy in acting on the convictions he has. Patients are not helped by practitioners who, in the rustic phrase of the English, are "neether nowt nor summat." They thrive rather in an atmosphere charged with expectant optimism and with the courage of firm belief.

Just as harmful as, even more harmful than, apathy is rash fanaticism. And in medico-dental domains, there are, unfortunately, ever some who cannot adopt a reasonably moderate attitude; they hanker after extremes; they demand the thrills either of ultra-optimism or of ultra-pessimism. We all know an occasional physician or an occasional dentist who will not stop at the removal of demonstrable infection but who demands a "clean sweep" of the whole dental outfit. "Your teeth," he says "may be at the bottom of your trouble—better let them all go." And we are equally familiar with the occasional physician or the occasional dentist whose mind cannot go along with that of his fellows, who is "utterly against this new-fangled idea that your teeth have anything to do with your joints;" who "knows lots of people who never had a tooth pulled in their lives and yet never had arthritis," and who valiantly declares that he would "sue for damages the doctor or the dentist who robbed him of any of his teeth," because of the supposed dangers, local or distant, of gingival or of periapical infection.

We must not be surprised at these abnormal attitudes, for they lie deep in the nature of some human beings. Are they not comparable to the tendencies, in politics, of the communist and of the dyed-in-the-wool reactionary; in ethics, of the ascetic saint and of the monstrous scoundrel, or, in criticism, of the extravagant praiser and of the fierce abuser? Someone has said that "in this world, white is never white, and black is never black," but it is only the more wise who can recognize the shades of brown and grey.

Undoubtedly, there are matters connected with oral sepsis that are still *sub judice*. I may mention, as examples (1) the problem of the pulpless tooth that is unassociated with other clinical or roentgenologic evidence of infection; (2) the problem of the criteria for operative intervention when there are definite but only slight signs of periapical involvement, and (3) the problems of natural and of induced resistance to dental caries on the one hand and to the occurrence of metastatic infections from oral foci on the other. There are problems that deserve most earnest consideration by original investigators. Let us hope that more light may soon be thrown on them by an extension of clinical and experimental research.

ENDOCRINE FUNCTIONS AND THE TEETH

Let us turn from the distant effects of oral sepsis. Let us next consider the effects on the teeth of certain disturbances elsewhere in the body—about all of certain anomalies of the functions of internal secretion. Just here, studies by internists have been quite illuminating as to the origin of various dental abnormalities.

You will recall that the endocrine glands (among them the thyroid, the parathyroids, the pituitary, the suprarenals, the gonads, the thymus and the islands of Langerhans of the pancreas) perform a most important function for the body as a whole by yielding to the blood secretions which contain specific chemical substances that they manufacture. Some of these substances (notably thyroxin, epinephrin, pituitrin, insulin) are now very well-known; others, more obscure, are under careful investigation. The conditions under which these substances are manufactured, the amounts of them that are required, the correlation of the functions of the several glands of internal secretion with those of the vegetative nervous system, and the influence of heredity and of environment in the "endocrine make-up" of single persons are gradually becoming better understood. We now know a number of bodily states that we attribute to underactivity of certain of the endocrine glands, and we know others that we attribute to overactivity of these glands. Most striking contrasts, for example, are (1) myxedema, due to underactivity of the thyroid, and exophthalmic goiter, due to overactivity of the same gland; and (2) acromegaly, due to overactivity of the pituitary gland, and the so-called dystrophia adiposogenitalis with micromegaly, due to underfunction of the same gland. Not only the form but also the functions of important parts of our bodies depend, to no small extent, on the regulatory activities of these peculiar glands.

By no means the least interesting of the influences exerted by the internal secretions are their effects on the development, the form and, perhaps, the resistance of the teeth. Let me cite a few of these. Many of the anomalies of dentition, and particularly delayed eruption, have been shown to be dependent on insufficiency in early life of the secretion of the thyroid gland. Administration of the thyroid gland of the sheep to hypothyroid children hastens the eruption of the developing teeth.

Again, the spacing of the teeth in the jaws depends to a large extent on the growth of the bone in those jaws, and this growth, in turn, appears to be regulated to a large extent by the amount of secretion produced by the pituitary gland (or *hypophysis cerebri*). Thus, in acromegaly, a disease in which there is overactivity of the pituitary gland, the jaws grow to a large size and the teeth may accordingly be more widely separated than normally. The so-called "hag teeth" are supposed thus to originate; and the old idea that such teeth are in some persons associated with increased sexual activity may have its foundation in the fact that the libido is often found to be increased in hyperpituitarism, especially in its earlier stages.

Another example of the relation of endocrine function to dental conditions is the peculiar dental anomaly sometimes observable in persons who suffer from chronic tetany, a disease in which there is prolonged underactivity of the parathyroid glands. The teeth of these persons are marked by parallel rows of depressions of dark discoloration due to defects in the enamel. The condition is rather rare, but I daresay some of you have observed it.

I might cite other examples of endocrine and dental or gingival relationships, such as the large medial incisors and the relatively very small lateral incisors in the upper jaw observed in status thymicolymphaticus or such as the marked tendency to severe pyorrhea alveolaris so often associated with the hyperglycemia and the hypo-insulinisn of diabetes mellitus; but those I have already referred to will suffice to emphasize the great significance of the endocrine functions as regards intra-oral conditions. The field is a fascinating one for original study; doubtless, as knowledge continues to progress in this domain, other dento-endocrine correlations, as yet unknown to us, will be established.

VITAMINS AND THE TEETH AND GUMS

During the past decade, internal medicine has been enriched by an extension of our knowledge of the relationships of the content of the body in certain so-called vitamins to health and to disease. The better known of these vitamins have been, you will recall, designated by the letters A, B, C, D and E. The significance of each of these several vitamins for the welfare of the body has become recognized, and, gradually, the sources of these vitamins in particular foodstuffs are being determined. Without an adequate supply of each of these vitamins, certain functions of the body cannot be performed normally or serious disease symptoms may develop. Clini-

cians now refer to the states dependent on lack of, or insufficiency of, vitamins as "avitaminoses" or "hypovitaminoses," respectively.

As might have been expected, these newer studies have not been without significance as regards the pathology of the teeth and gums. Take, for example, vitamin A. It has been clearly demonstrated that an adequate supply of this vitamin is essential for the maintenance of the natural resistance of the body against certain infections as well as for the support of both the physical and mental vigor of the human being. With the ever-increasing attention that is being paid to septic processes originating within the mouth, it is but natural that both dentists and physicians should have begun to consider carefully the possible relation of deficiency in vitamin A to those infections. One of the chief vehicles of vitamin A is milk-fat, for which, indeed, there is no satisfactory substitute. Each adult requires one ounce of butter (not margarin), and from three-quarters to one pint of milk a day in his diet; whereas, growing boys and girls require much larger amounts, the ideal ration of fat (from milk and butter) for each boy every day being as much as 200 gm., according to Gephart. Unfortunately, as Cramer emphasized, at the annual meeting of the British Association last summer, such an amount of milk fat is at present beyond the reach of the majority of the boys and girls. Thus, he estimates that, in Great Britain, "the available milk-fat, if rationed equally, would give only some 30 gm. a head of the population;" whereas, the minimal quantity actually needed for each person is from 40 to 50 gm. We are, perhaps, not so badly off in America; but there can be no doubt that, even here, there are vast numbers of persons who fail to ingest daily the optimal amount of milk fat for the maintenance of health and vigor and particularly for upholding resistance against infections. Moreover, it has now become clear that "the world's production of milk falls far short of the world's need of that article of diet." As soon as people realize the fundamental importance to human health of milk fat, largely because of its content of vitamin A, there is bound to be a greatly increased demand for milk and milk products and an urgent insistence on an adequate supply for each person. The problems involved are not only national but also international. It will be interesting to watch the influence of the newer knowledge on the development of dairy farming in each country and of the regulation of imports and exports of butter by different countries. Only half of the available milk fat of Great Britain, for example, is produced at home. The other half is at present imported chiefly from Denmark, Australia and New Zealand. Any country that exports a commodity so essential for the health of its own population as is butter fat should make sure before doing so that it really has a "surplus" of that commodity to dispose of. It may be, as has already been intimated, that Denmark is at present actually sacrificing her own interests in permitting so much butter fat to be diverted from her own people. The matter of supplying vitamin A in the form of milk fat would seem, therefore, to be one of

vast concern not only for individuals but also for governments. Especially if populations are to increase, the problems of creating new sources of supply to overcome prevailing deficiency will become ever more urgent. Milk and butter, in addition to vitamin A, contain, of course, other constituents that are of great value for the body; but alone because of their content of this precious vitamin, the importance of educating the public freely to partake of them should now be obvious.

The American physician who has visited the wards and the outpatient departments of the great hospitals of London and Edinburgh has been much impressed by and has commented on the shocking state of the teeth and gums of the patients. Part of the contrast with conditions in similar institutions in America (where they are still bad enough) may have been due to less education of the masses in Great Britain to the importance of the regular dental toilet, and partly to the earlier and far greater development of expert dentistry in America and provision for extension of its benefits to the poorer classes; but one cannot but wonder if the really terrible conditions that have prevailed in Great Britain may not have been due, in part at least, to lowered resistance because of an insufficient supply of milk and butter and the vitamin A of which these foods are the vehicle. Certainly the studies of Mellanby point strongly to this view.

Still another condition that interests equally those who work in internal medicine and those who work in dentistry has had new light thrown on it by researches on vitamins. I refer to the spongy, bleeding gums of the scorbutic. It has, of course, long been known that the symptoms of scurvy, including the disorder of the gums due to it, can be made relatively quickly to disappear by the administration of fruit juices, especially orange juice, lemon juice and lime-fruit juice. Studies of the vitamins have revealed the fact that it is a particular substance, now known as vitamin C, which is present in fruit juices, and, when ingested in sufficient quantities, prevents the development of, or actually cures, scurvy. The dentist or physician of today who notices spongy or bleeding gums will find out immediately whether or not his patient is eating enough fruit before he dismisses a deficiency in vitamin C from the list of possible causes.

I might cite the dental conditions in rickets, another disorder due to deficiency in a special vitamin, if still further evidence of the importance of vitamin studies of dentistry were desired; but the example already given will suffice to illustrate the fundamental importance of our field of these newer investigations. Not only for the body in general, therefore, but also for the teeth and gums in particular, is it essential that, day by day, each of us shall take adequate amounts of the special foodstuffs that are the carriers of these promoters of the normal functions. To fail to do so is to expose oneself to grave perils.

My theme, as you will have observed, is of wide embrace. The topics that I have adumbrated by no means exhaust its reach. I should like to have referred also to the newer biologic studies of the human constitution and their relations to dentistry; but I forbear. I have already made large claims to your attention and I should be loath to fatigue you.

We can, I think, feel hugely encouraged by the progress that is being made in domains of our common interests. Very much of high significance has already been accomplished; the young and eager investigators of our two professions will gradually accomplish more. That which is not possible today, may, as ardent researches are continued, be attainable tomorrow.

But we should not strive too much after immediate, dramatic or sensational results. Let each of us be content steadily to cultivate his own particular garden. It is regular work done with quiet enthusiasm in a number of small fields that, in the long run, does most to bring to maturity facts and principles that are important and enduring.

DISCUSSION

Joseph L. Miller, Chicago, Ill.: We should neither ignore nor overlaud the theory of focal infection. It is still on trial and time will render the decision. Our attitude should be one of critical observation, carefully analyzing apparent results, in an effort to determine whether they are due to the treatment or whether they can be accounted for in the natural course of disease. He who experiments in clinical therapy must first have a wide acquaintanceship with the course of untreated disease; otherwise, he may assume unwarranted credit. James Jackson, in his delightful book "Letters to a Young Physician," relates that, when he assumed charge of a service at the Massachusetts General Hospital, it had been customary to discharge patients as cured, improved, not improved and died. He eliminated the word "cured," replacing it by "well" or "recovered," giving as his reason that the word "cured" implied an act of man; the word "recovered" gave Nature at least a partnership in the happy termination. When it comes to therapy, we are all inclined "to let reason take flight." No physician wishes to withhold possible benefit to the sick, and no physician wishes to be known as a therapeutic nihilist. This accounts for the many therapeutic fads that have held the stage for a longer or shorter period of time before the curtain slowly falls and they are forgotten. The late Sir William Osler has expressed this thought in his usual delightful manner: "In therapy, the placid faith of the believers, not the fighting faith of the aggressive doubter, has been our besetting sin." The value of a therapeutic measure can be determined only by using it in conjunction with untreated cases as controls. This is just as essential in the therapy as are the four rules of Koch in bacteriology. This acid test has not been applied in focal infection, and our attitude at present should be one of open-minded conservatism. A patient to whom I had ministered for many years called to see me, a few years ago, complaining of an acute iritis. Later development showed that it was of the recurrent type. He was referred to an ophthalmologist, who, in turn, referred him to several specialists, who searched for and treated various foci of infection. After a considerable period of freedom, his was officially reported as a cured case of recurrent iritis. About one year ago, he again visited my office with a recurrence of the iritis, and gave the following history: A few days previously, he had a tooth extracted, and immediately after this, the iritis appeared—not due, I believe to the infections from the tooth, but rather to streptococci from the mouth gaining access to the wound. One week ago, he again came to the office complaining of another attack of iritis, with the following history: Ten days previously, he developed an acute and severe enteritis, which continued for one week. His iritis recurred during the course of this trouble. It might be fair to assume that a similar streptococcal infection of the bowel accounted for his iritis. I believe localized acute infection plays a greater rôle in metastatic disease than chronic foci. In the former, we are dealing with a new invader and an unprotected host. In the latter, as for instance an alveolar abscess, with an infection that has lost much of its virulence and a host that has acquired an immunity. The chronic arthritic suffers from recurrent subacute exacerbation and these conditions are frequently preceded by an acute upper respiratory tract infection. I am glad that Dr. Barker has called attention to the importance of diet in tooth preservation. F. Wood Jones has made some interesting observations on the teeth of some an-

cient mummies and skeletons in Nubia. These people lived from 6,000 to 8,000 years ago. Buried in the desert sands, in many cases the tissues and, in practically all cases, the bones, were well preserved. The teeth of the common people showed very little evidence of dental caries. The teeth of the aristocracy showed considerable evidence of trouble. He assigns this difference to the very coarse foods used by the poor. As we study the teeth of more recent mummies, dental caries becomes more common in both groups until, at the beginning of the Christian Era, it was far from infrequent. Although dental caries was infrequent in the ancient common people of Nubia, 40 per cent of them gave evidence of osteoarthritis of the spine.

Dr. Barker (closing): The discussion has brought out matters of importance, for which I must thank those who have participated in it. An attitude between ultraconservatism and ultraradicalism in the matter of extraction of teeth is the one that appeals to me. It seems to me to be ultraradical to extract all pulpless teeth, regardless of the absence of any signs of periapical infection; and it seems to me ultraconservative to retain pulpless teeth when roentgenograms reveal evidence of definite periapical rarefaction of bone. Many patients, particularly those suffering from nervous breakdowns of various sorts, often undergo a whole series of operations, including extraction of teeth, removal of the appendix, exploration of the gallbladder, excision of tonsils, suspension of the uterus, dilatation of the ureter, etc., in the hope of improvement of conditions which depend rather on hereditary tendencies and faulty mental and physical hygiene. This is to be deplored. Of course, when there are definite indications for the need of such operations, they should be performed for the sake of the general health. On the other hand, I have seen many cases of arthritis and of a generally run-down condition in which great improvement quickly followed extraction of teeth that were really infected. Pulpless teeth should be examined by roentgen ray, as a matter of routine, at least twice a year. If my dentist should find in my mouth a pulpless tooth with extensive infection about it, I should want him to extract the tooth promptly; for I have no desire to develop an infection arthritis or a *viridans* endocarditis.

A NEW SYSTEM OF FIXATION OF OBTURATORS*

By J. G. SCHUIRINGA, Utrecht, Holland

THOUGH the general trend at the present time is toward surgical treatment of congenital cleft palate cases, especially in early infancy, there remain a number of patients who have to be treated mechanically. Fixation of the obturator in this class of dental work is often a difficult problem. With our younger patients especially, it sometimes seems impossible to obtain good results. It is of the utmost importance to place the artificial plate as early as possible, to allow proper adaptation of the tissues and thus obtain good results in articulation and the act of swallowing.

Generally at birth, the amount of tissue present would be sufficient to form the palate normally. Function is, however, necessary to allow proper further development of the tissues. The child without a cleft palate plate tries, by all possible means, to compensate the faulty closure of the palate, and thereby uses the tissue abnormally, so that some parts become hypertrophied, while others show marks of atrophy. It is therefore of the utmost importance to place the obturator at as early an age as possible, to obtain full benefit of the acquirement of the speaking habit, with the help of an elocutionist, because vocal usefulness of the obturator may increase with the age of the patient.

Correct vocal articulation necessitates the separation of nasal and oral cavities to prevent the passage of air into the nares. The nasal twang, as commonly observed by neglected cleft palate patients, is a serious drawback for the patient in later life, and, psychically, a depressing factor in childhood. The assimilation of food is interfered with, and there is an annoying tendency for the fluid and saliva to pass through the nose. In breathing, the moistening, purifying and warming of the inhaled air before reaching the lungs is lessened. This must convince us of the importance of helping our young patients as early as possible; which is by no means a simple procedure. We all know by experience the difficulties attending this form of dental work on children.

Renewal of the plate is necessary at intervals until the jaw reaches the maximum development. Furthermore, lack of space in the mouth at an early age makes intricate appliances impossible.

The proper fixation of the appliances is the greatest source of trouble, as we have only deciduous molars at our disposition. The deciduous molars are not suitable for carrying clasps satisfactorily. Suction disks are of no use because of the small flaps of tissue at our disposition even in the inoperable cases. The other attachments in use for

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug 24, 1926.

fixation on the permanent teeth cannot give good results.

Before trying to describe my improved method of fixation for the obturator, I shall first state the features that a good fitting plate must possess in order to assure the most satisfactory results:

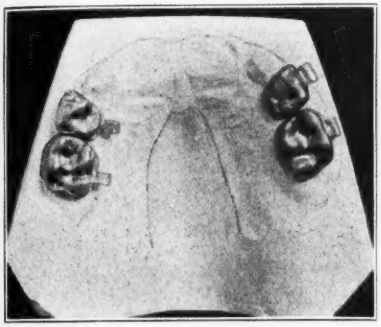


Fig. 1 (Case 1).—Model of upper jaw.

1. The construction must be light, but strong enough to guarantee maximum efficiency and to prevent fractures.

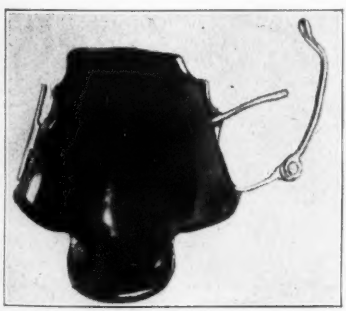


Fig. 2 (Case 1).—Obturator.

2. Next to strength, simplicity of construction and operation is a prime factor. The appliance must lend itself to be easily removed and must not require too much dexterity on the part of the patient's parents for daily removal to cleanse the oral cavity and the appliance.

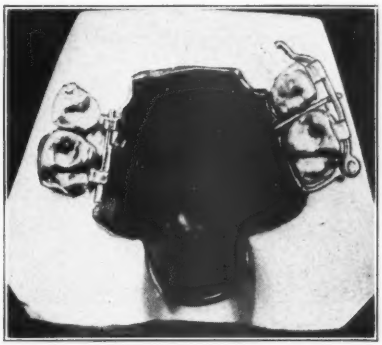


Fig. 3 (Case 1).—Obturator in place.

3. Fixation and stability must be sufficient to prevent the child itself from removing the appliance too easily. It must withstand the strain and stress of mastication without loosening.

4. The normal expansion of the jaw in its development must not be checked in any way.

5. Allowance must be made for the normal shedding of the deciduous molars and also for the eruption of the permanent bicuspids.

Fig. 4 (Case 1).—Schematic drawing showing obturator in place.

6. When the deciduous molars are used for fixation, they must not be overtaxed and must not be considered as

abutments before they have fully erupted and are sufficiently fixed in the jaw. Otherwise, premature loss is caused, which means a failure.

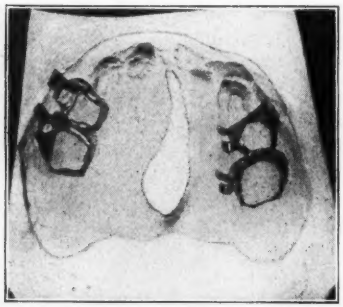


Fig. 5 (Case 2).—Model of upper jaw.

7. Deciduous teeth used as abutments must be carefully protected to be saved as long as possible from caries.

8. Every deciduous molar used as an abutment must fully retain its individual mobility. This is physiologically normal and also saves us much trouble, since the molars are shed at different

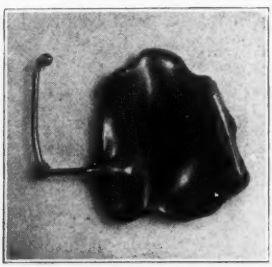


Fig. 6 (Case 2).—Obturator.

periods, and it is not practical to connect the deciduous molars at one side.

9. When deciduous teeth are used as abutments, it is practical to use more than one at either side. If one has been lost during the shedding period, the other still fixes the plate, and it is not so often necessary to repair the appliance, except for fixation. We also

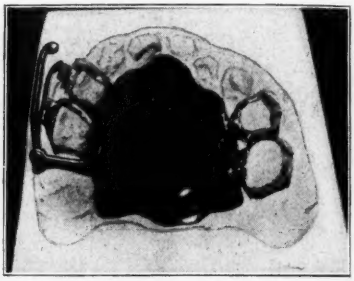


Fig. 7 (Case 2).—Obturator in place.

must never forget that the apparatus in every case means a heavy tax for the very young deciduous teeth, and the position is much improved if we can distribute the stress on a larger number of abutments.

10. The sound dental pulp in the deciduous teeth used for fixation must remain intact.

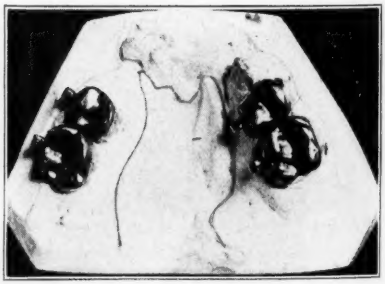


Fig. 8 (Case 3).—Model of upper jaw.

With these ten points in mind, I constructed my appliance for fixation of the obturator.

To illustrate the details, I shall use

my first case, in which I had to resort to some other method of fixation than was commonly used.

Fig. 9 (Case 3).—Obturator.

This first case, I treated personally, to be able fully to work out the more important details. The photographs taken of this case are much better than

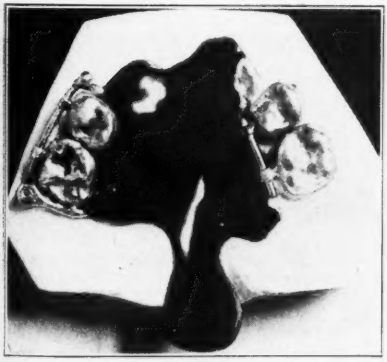


Fig. 10 (Case 3).—Obturator in place.

those of later patients and give the best idea of my method. Some of the pictures of this case, I have previously published.[1]

The other cases were treated later, under my supervision, by my assistants (most of them by Mr. Bicknese, and

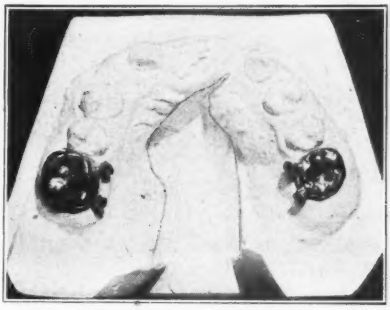


Fig. 11 (Case 4).—Model of upper jaw.

one case by Mrs. Kippell), and may serve to explain this method further.

REPORT OF CASES

CASE 1.—*History.*—A girl, aged 4 years (Figs. 1-4), had a cleft of the palate run-

Fig. 12 (Case 4).—Obturator.

1. Schuiringa, J. G.: Tijdschr. v. Tandheelk., June, 1923.

ning through the soft and hard palate. In the upper jaw, there were present on both sides the first and second molars. The deciduous left cuspid was also present. The palatal cusps of the first molar on both sides had been destroyed by caries, but the pulps in all molars were sound. Of the four upper incisors, only the roots were present. In the lower jaw, all the teeth were present and in good condition. Occlusion with the other jaw was fairly near normal.

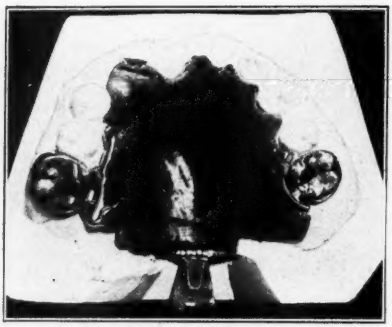


Fig. 13 (Case 4).—Obturator in place.

Fig. 14 (Case 5).—Obturator.

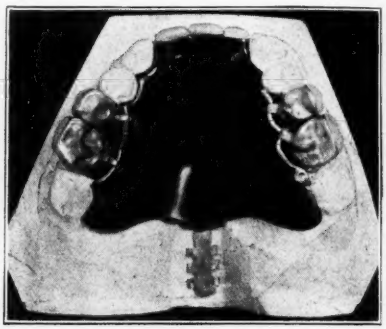


Fig. 15 (Case 5).—Obturator in place.

Treatment.—It was determined to use the four upper molars as abutments. Only the cusps were slightly ground down and the cavities on the palatal cusps of the first molars were excavated. No root-canal treatment was necessary, as all pulps were sound. Gold bands were made, closely fitting over the molars, of 24 carat gold, 0.3 mm. in thickness. An impression was taken with the four bands in position; models were made, and the occlusal plates (24 carat, 0.3 mm) were swaged and soldered.

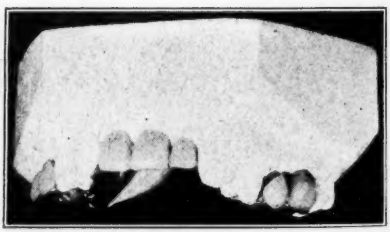


Fig. 16 (Case 5).—Model showing missing teeth replaced.

Comment.—When later the crown with the attachment is cemented in position, it is very easy to burnish the occlusal planes and also the gingival margin under the cingulum in this soft metal in order to have it fixed there.

On the outer surface, the band is strengthened with solder. On the palatal surface of the crowns on the right side, horizontal oval

Fig. 17 (Case 5).—Method of fitting crown to abutment.

half-open tubes are soldered, with the opening (long side) toward the palate, about 1 mm. above the gum margin.

On the crowns of the left side, horizontal round tubes, open to the buccal surface, are

Fig. 18 (Case 6).—Obturator.

soldered bucally. The open portion of these tubes is about one third of their circumference, which allows the gold wires to clip into the tubes.

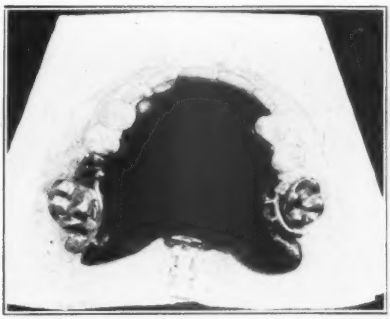


Fig. 19 (Case 6).—Obturator in place.

The palatal plate is made of black vulcanized rubber. On the right side of this rubber plate, a platinum-gold wire is attached, which slips into the open oval tubes on the palatal surface of the right molars. The frontal part of the plate leaves the front teeth entirely free for the eruption of the

Fig. 20 (Case 7).—Obturator.

permanent incisors. The round wire in the oval tubes on the palatal surface of the right upper crowns cannot fit snugly, but allows for space. When the molars move bucally, in the development and expansion of the

upper jaw, the round wires in the oval tubes have sufficient space to allow this movement. When first placed, the palatal wire rests against the molar side of the oval tube.

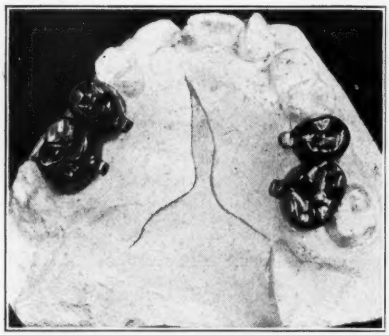


Fig. 21 (Case 7).—Model of upper jaw.

On the left side of the rubber plate distally, a platinum-gold plate extension is vulcanized, to which is attached a hinge or turning joint, carrying a platinum-gold wire running on the buccal side of the left molars. This wire, after the plate is brought into position, turns around on the hinge and is brought into position in the round horizontal buccal tubes of the left molars. In Figure 3, this

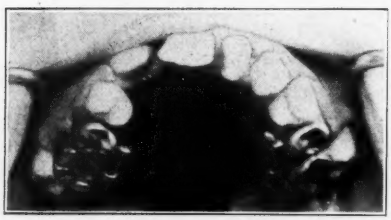


Fig. 22 (Case 7).—Appearance of upper jaw with crowns and obturator in place.

hinged wire is seen running on the buccal side of the left molars, and ending against the deciduous left cuspid. This wire fits into both horizontal tubes, leaving each deciduous molar its individual mobility, as far as possible.

To put in the plate, we first have to slip the wire on the right side of the plate into the oval palatal tubes of the right molars. Next we press the plate into position against

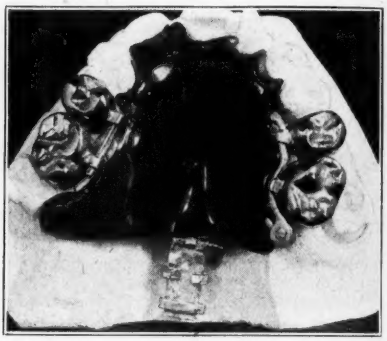


Fig. 23 (Case 7).—Model of upper jaw showing obturator in place.

the palate, and finally the wire on the left side is pressed into the round tubes. Further, in this case, I added the wire extension between the left deciduous molars, which gives additional support to the plate. This releases

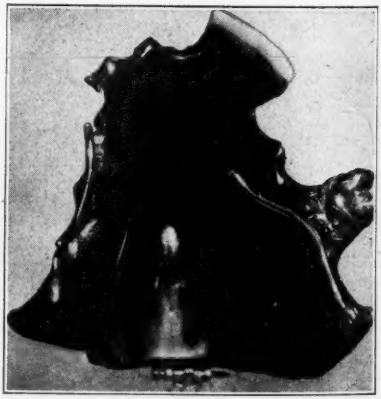


Fig. 24 (Case 8).—Obturator.

the strain on the plate distally, caused by the hinged wire, and increases the grip on the molars.

I have only allowed extra space on the right side and not on the left, but seeing that every plate does not fit closely after the least

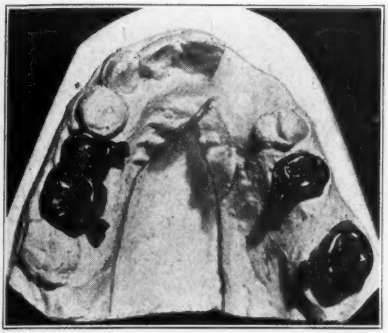


Fig. 25 (Case 9),—Model of upper jaw.

expansion of the jaw, it is not such a great drawback that only one side must give the space for expansion from right and left, especially not in the case of large defects. In any case, one cannot avoid having repeatedly to alter the plate during the years of growth.

Technically, it would be possible to allow for the movement of the plate on the other

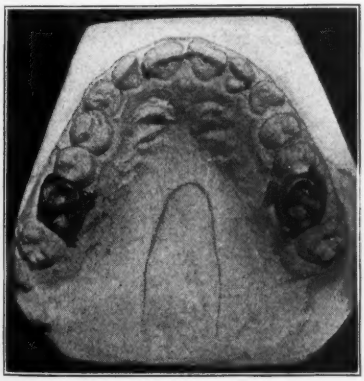


Fig. 26 (Case 9).—Model of upper jaw.

side as well. The hinges can be fixed on the palatal side, in the way that I use this method for older patients, and then the space in the tubes can be made larger. But in the tiny mouth of a child, this fairly big wire with tubes palatally would take up far too much space. Moreover, it is not essential to make the

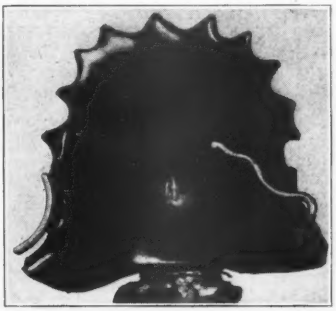


Fig. 27 (Case 9).—Obturator.

appliance complicated. The chances of breakage are thereby increased, and for patients living far away, frequent journeys should, if possible, be avoided.

Generally speaking, experience has taught me that prevention of breakage of all jaw appliances is of the utmost importance, and for this reason I am certain that every appliance should be constructed as simply and

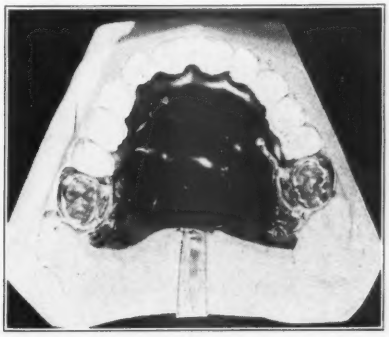


Fig. 28 (Case 9).—Obturator in place.

strongly as possible, without unnecessary, complicated fixtures.

The upright plate (platinum-gold extension for hinge fixation) distally along the

second left molar might possibly be a source of disturbance in the eruption of the first permanent molar. In that case, a little could be ground off the gold crown of the second molar and the plate then bent a little in the mesial direction. In case the bite is made higher by the crowns, this has the advantage that there is more space for the plate extension, and this heightening of the bite does not cause any trouble.

It would seem, therefore, that the above described system of attachment is in accordance with the most important requirements.

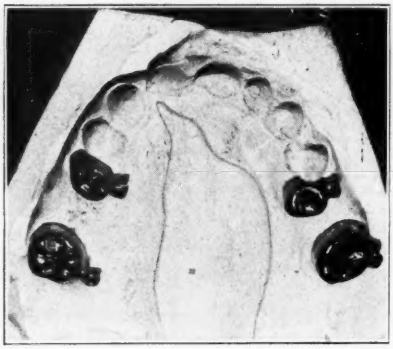


Fig. 29 (Case 10).—Model of upper jaw.

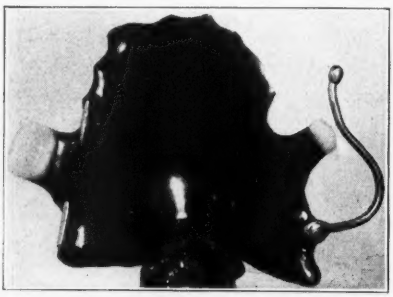


Fig. 30 (Case 10).—Obturator.

CASE 2.—A girl, aged 7 years, had a cleft of the hard palate alone. For fixation, only bands were used. (Figs. 5-7.) The hinge was placed on the left in this case. No extra extension was used between the two abutments. Seeing that the plate had to cover the hard palate only, it did not need so much support as in Case 1.

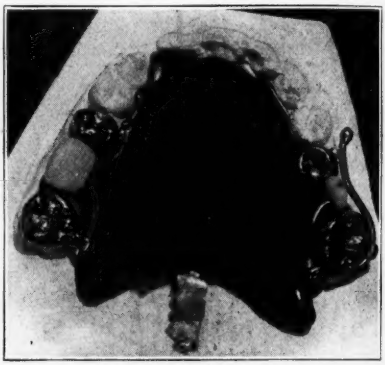


Fig. 31 (Case 10).—Obturator in place.

CASE 3.—A boy, aged 6 years, had a broad cleft through the hard and soft palate. The intermaxillary bone was mobile. Four deciduous molars were present as well as a deciduous left cuspid. As in Case 1, caps were placed on the abutments. The hinge was placed on the right side because the space of the missing right cuspid was utilized for an extension in the plate and for the knob

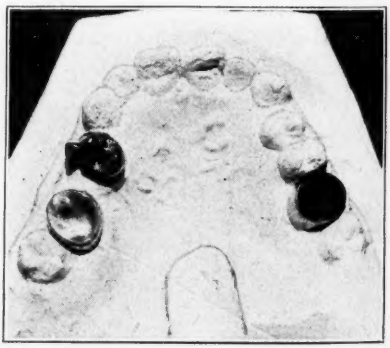


Fig. 32 (Case 11).—Model of upper jaw.

of the hinge. The front was left entirely free in this case also. (Figs. 8-10.)

CASE 4.—A boy, aged 10 years, had a large cleft of the hard and soft palate. The permanent teeth were: first molar, first and second bicuspid (left and right) and a few permanent teeth in the front in an abnormal position. (Figs. 11-13.)

Because of their recent eruption, the bicuspids were not taxed with an appliance, but, as an experiment, I used the permanent molars only, as abutments. In this case, there was space to fix all tubes and the hinge on the palatal side. They gave no trouble in speaking. The fixation proved to be sufficient since two tubes instead of one were soldered

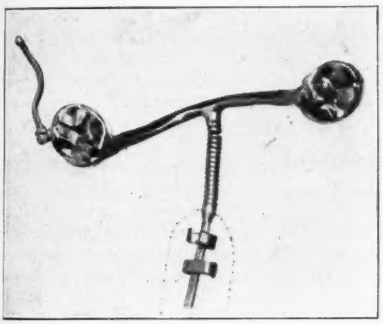


Fig. 33 (Case 11).—Appliance used to close small cleft of soft palate.

to each abutment, which shows no sign of overtaxation. The appliance was photographed in wax because of lack of time on the part of the patient.

Comment.—When this system is adopted for adults, various changes can be made in it. In the first place, all the tubes may be round, because the jaw is fully developed. Furthermore, all the tubes can be fixed palatally for esthetic reasons, and, according to my experience, they give no trouble there. There is then also an opportunity for providing crowns with porcelain facings on the abutments; if possible, Steele's crowns. In this way, the appliance cannot be detected. In most of the larger appliances, I prefer to use a crown on the abutment rather than an inlay, because patients are often careless with regard to oral hygiene until they actually experience trouble. As a rule, these patients do not come in for further treatment until caries has made tremendous progress and until it is too late for even a crown. Crowns protect against caries, and the pulp is removed while sound, which is greatly to be preferred to the extirpation after an often long drawn out gangrenous process; although I entirely agree as to the desirability of retaining a pulp as long as possible under other circumstances.

I shall take one of my first adult cases for the description of the treatment of this class

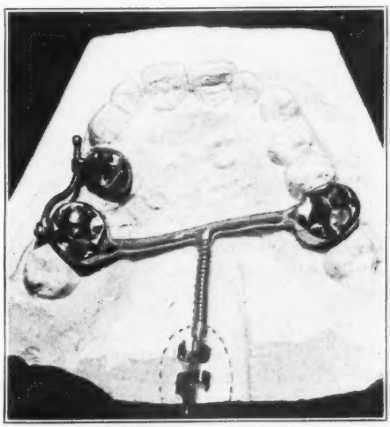


Fig. 34 (Case 11).—Model showing appliance in place.

of patients for the same reason that I took Case 1.

CASE 5.—A male, aged 22 (Figs. 14-17), had a large cleft of the hard and soft palate. The first and second molars, the bicuspids and the cuspids of the upper jaw were present. The incisors had been extracted. The first molar and second bicuspid on each side were used as abutments. On the left side, in an interproximal space, one tube was fixed on the palatal side of the first molar. The second bicuspid was also provided with one tube. In these, a wire with a hinge rested. On the right side, tubes, not oval but round, were placed, and filed away toward the palate. The missing teeth were supplied. As the patient was uncommonly unintelligent and

awkward, it was quite safe to fit the crowns as securely as possible on the abutments, which I executed as follows (Fig. 17):

The whole was prepared for a shell crown, but on the palatal side, the root was left as high as possible. Buccally, space was made for the facing by grinding away that side slantwise. A simple roof-shaped root plate was fixed on the matrix. Through this roof plate, a strong pin entered the palatal canal. On the foregoing basis, the facing was brought into position, and the remainder of the crown was cast; after which the tubes were fixed palatally.

Comment.—In cases of this nature, it is also possible to use Steele's crowns, which run up to the palatal cusp occlusally; but is always necessary to retain a high solder-surface palatally, as the rubber plate must still rest on the wire. On the hinge side, the plate must be filed away to make room for the tubes.

As no repair has been necessary during the last four years in this case, the fixation may be considered satisfactory.

CASE 6.—A youth, aged 18, had a cleft of the alveolar process (left) and hard and soft palate. The right and left second molars were present as were the second and first bicuspids; the first molars were missing. A few of the front teeth were also missing. The palate plate and mobile extension for the soft palate are shown in Figures 18-19. The second molars were used as abutments, and fixation was made palatally. The space that had been occupied by the first left molar was too small for a substitute. On the right first molar, a facing with gold plate was used, the extension being fixed on the plate. By placing the hinge on this side of the plate, there was a double advantage: in the space of the absent first molar, there was room for the knob, and this kept the plate in position at the same time.

On both sides of the crown of each abutment, tubes were soldered in such a way that they projected very little, and were therefore not an objection. The missing front teeth were supplied. This patient had not previously worn a plate, but quickly became accustomed to it and learned to speak very well in a short time.

CASE 7.—A girl, aged 14 (Figs. 20-23), had a large cleft of the hard and soft palate. The first and second molars and first and second bicuspids were present on both sides. Some of the front teeth were present, but were irregular. On the right and the left sides, the first molars and second bicuspids were used as abutments. They were provided with crowns with one tube each. With a hinge on the left, palatally, the plate was sufficiently secure.

CASE 8.—A youth, aged 19 (Figs. 24-25), had a cleft of the hard and soft palate. The central and lateral left incisors were missing, as was the first left molar. The first right molar and second right bicuspid, the second left molar and second left bicuspid were used as abutments; each with one tube. The hinge was on the left side.

CASE 9.—A girl, aged 17 years (Figs. 26-28), had a cleft of the distal half of the hard and soft palate. The teeth of the upper jaw were sound. The first molar on either side was used as an abutment. Crowns were made, each with two tubes. The hinge was on the left side.

CASE 10.—A girl, aged 19 years (Figs. 29-31), had a large cleft of the hard and soft palate. The first molars on both sides were missing, as was the right lateral incisor, but with no resultant open space. The second molars and second bicuspids were used as abutments on either side. Gold crowns with one tube were placed bucally on the hinge side (left), in order to leave more space palatally. Because of the palatal movement of the second bicuspid, a suitable place for the knob of the wire was left by this tooth.

CASE 11.—A girl, aged 19 (Figs. 32-34), had a cleft of the soft palate. Except for the previously extracted second right bicuspid, all the teeth were present. The use of a plate was avoided by providing the carious first molars with double crowns, while on the right side the appliance was fixed approximally by a wire with a hinge to a tube on the first right bicuspid. The whole appliance was securely fixed in this manner. In the distal direction, the mobile extension for the soft palate was fixed.

Comment.—In a similar manner, it is possible to close small acquired defects of the palate with a small plate, connected with the teeth, and retained in position by an appliance of small size.

RECENT ADVANCES IN FIXED APPLIANCES*

By HENRY C. FERRIS, D.D.S., New York City

A SURVEY of recent literature for the advances in fixed orthodontic appliances designed to reduce malocclusion of the teeth displays no startling invention with which to conjure; and leaves us with the same fundamental mechanical principles with problems in three dimensions.

To say that there has been no advance as a result of the concentrated efforts of hundreds of earnest searching minds would be an injustice to the results of their labor. That orthodontic operations have resulted in far superior corrective work of permanent value, as a result of greater study, cannot be denied in the presence of the ever-improving photographic, radiographic and plaster model records, together with the physiologic improvement of a constantly increasing number of cases.

The profession has added a chapter to the history of science which proves the result of refinement of the applied mechanical principles, specialized to satisfy a fuller knowledge of the structure on which we operate, during our treatment.

A special regard to the family and case history and the knowledge of the cause of pain incident to tooth movement has influenced the selection and application of the applied force on the growing alveolar bone, stimulating the physiologic growth of the face and skull to overcome arrested development of the teeth.

The recognition of defects in selective regions that show lack of ossification and structural strength due to loss of functional stimuli has been the source of careful consideration, and has supplied a solution for lack of bilateral action where equal force has been applied with unilateral results.

The knowledge that has been developed through histologic studies has proved that intermittent forces result in irritation, inflammation, and pathologic absorption of tissues, which have to be rebuilt at the completion of the tooth movement, and frequently result disastrously in the erosion of the soft tissues, and even in devitilization of the nerve pulps of the teeth, and absorption of the apices of the roots of the incisors, as recently presented by A. H. Ketcham, of Denver.

The study of these applied forces has given us still another field of advance, reducing a complication of numerous stresses and strains that are incalculable where extensive tooth-

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

movement is required, and therefore, impractical, as they are counter-acting, and retard the desired result. This information has induced the search for simplicity in the application of power, that the amount of force applied to the teeth might be measured mechanically, and more accurately, and applied with some degree of standardization, with a control of its maximum stimulation.

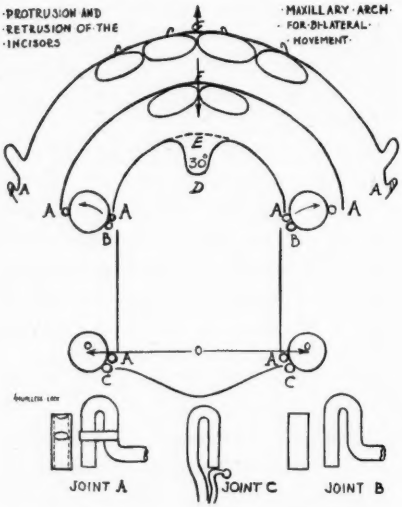


Fig. 1.—Maxillary arch for bilateral movement.

The rigid attachment of means of force to the teeth to be moved has largely overcome lost motion, and has eliminated inflammation and pain, where the number of bands on the teeth have been reduced to a minimum, avoiding the counter action of the applied force, and allowing the teeth freedom of movement; and has simplified the study of the amount of the force applied.

Two distinct methods employing fixed appliances have been developed, which may be classified as "fixed" and "fixed removable." In the former, the arch wire and lever arms are soldered to the anchor bands. In the latter, the attachment is removable from the anchor bands, which simplifies adjustments. The "fixed removable" type has received favorable attention at the hands of the greatest number of operators be-

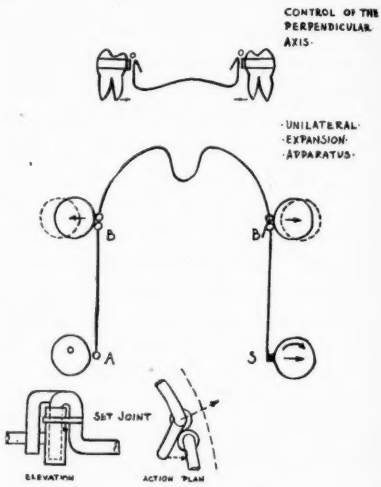


Fig. 2.—Unilateral expansion apparatus.

cause of its practibility, and many forms of lock attachments have been designed.

It will be impossible in the time allotted to review the merits of all the appliance designs recorded in our recent literature, but I will classify them according to the principles of application of force to the tooth movement, and the position of the appliance to the teeth.

Among the labial appliances, there is the development of Edward H. Angle's pin and tube and combination pin, tube

and ribbon arch appliances; Case's appliance, McCoy's "open tube" appliance, and George W. Grieve's half-round, pin and tube.

All these appliances utilize the elasticity of the arches, augmented with the screw or auxiliary loops for their power of stimulation. The measurement of these forces on the individual tooth is incalculable owing to the complexity of its distribution.

L. S. Lourie's high labial appliance depends entirely on the elasticity of the

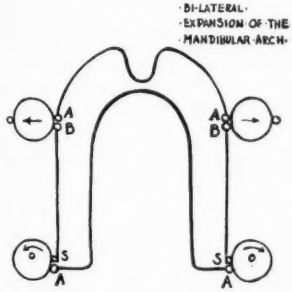


Fig. 3.—Apparatus for bilateral expansion of mandibular arch. In Figures 1-3, the labial and lingual springs were made of 0.038 inch spring elastic wire which is fitted into heavy lumen tubes. The vault arch was made of two pieces of 0.038 inch wire soldered together, which was held in position with latch springs.

arch and finger springs and is set to accomplish definite tooth movement. This method comes more within calculable limits and can be controlled by the expansion of the auxiliary loops.

LINGUAL APPLIANCES

The lingual fixed removable appliance of John V. Mershon is composed of a light base arch attached to the lingual aspect of the teeth, with a half-round pin and tube attachment to which small auxiliary finger springs are soldered to rest on the individual teeth, in order to augment nature's growing forces. This has proved particularly valuable in treating young subjects with mixed dentures during the periods of greatest development. The simplicity of application of this principle commends its use, as it comes more nearly within the ability of the operator to measure the force applied with the individual finger springs; but the total amount of force is still difficult to calculate.

Frederick L. Stanton's apparatus is based upon engineering principles, rotary centers being attached to individual teeth or several teeth for block movement. The motor force is a small elastic, operating on sliding lingual bars for measured movement. The design is based upon a predetermined arch and a mechanical survey in three dimensions of a model of the denture showing the condition of malocclusion, and the definite distance movements shown on his maps are controlled, but the force is intermittent. This method entails most exacting technic but gives the operator the greatest knowledge of the mechanical necessities of a case to be treated regardless of the appliance designed to accomplish the result.

My labiolingual apparatus is developed on engineering principles, being designed to supply the demands of a predetermined arch, utilizing four banded teeth on each arch as anchorages, and operating on rotating centers, usually on the molar teeth, with a vault arch to stabilize their position.

The removable lingual power spring is introduced in perpendicular, heavy lumen tubes, to control the perpendicular axis, its expansion power being set from its passive state for a definite amount of tooth movement. The amount of force applied is calculated according to the diameter of wire and its length; whether the arch is plain or with its auxiliary loop set at definite angles to the horizontal plane. The power of this spring increases according to the angle of the loop to the horizontal plane, until it advances to 90 degrees.

The following report (see accompanying table) of Mr. Louis Weinstein's laboratory on the analysis of two arch wires of given length with and without the loop, the loop being at an angle of 30 degrees to the horizontal, will make this clear.

Loop	Inches	Expanded Inches	Initial Force Pounds	Total Movement Inches
Spring as is	0.038	0.157	0.6	0.13
Smooth arch	0.038	0.157	0.6	0.065
Smooth arch	0.038	0.314	1.2	0.13
Smooth arch	0.025	0.157	0.22	0.13
Smooth arch	0.025	0.314	1.2	0.68

These values were computed for springs having the same width and depth of arch. The width is twice the depth.

By increasing the angle of the loop from the occlusal plane, the initial force of the spring is decreased. If the arch is spread so as to maintain the same initial force, the total movement is increased.

Initial Force is the force exerted by the spring when first inserted and before the teeth have moved. This force decreases as the teeth move and allow the spring to approach its normal position.

Total Movement is the distance the spring would move from its initial position (in place in the mouth) if there were no resisting force. When the spring has moved this distance, it will exert no force.

These values show that if a smooth arch were used instead of the arch loop, and adjusted to give the same initial force, the total movement would be greatly decreased. If the smooth arch were adjusted to give the same total movement, the initial force would be greatly increased.

If the smooth arch were made of 0.025 instead of 0.038 inch wire and adjusted to give the same total movement, the initial force would be relatively very slight.

If the smooth arch were made of 0.025 instead of 0.038 inch wire and adjusted to give the same initial force, the total movement would be relatively very great.

It would appear from this report, that a spring of 0.025 inch wire would be the most practical for our use, as the initial force would be a minimum, but there is another property of the wire which must be considered; that is, the force decreases as the spring expands. The light wire at two thirds its total movement will exert much less power, and permit oscillating movements of the teeth by the force of mastication, resulting in irritation and absorption of tissue. The 0.038 inch wire does not exert a sufficient initial force to cause discomfort nor persist sufficiently to overcome the aforesaid oscillating movements. I adopted the 0.038 inch wire spring with a loop for this reason and have found it controllable and practical.

The values reported are approximate only, but are sufficiently accurate to show the relative values of the different types of springs.

The adoption of this appliance design, originally, was born of necessity, as I had to treat a case of orthodontia for a patient who was to leave the country, and would be out of the hands of an orthodontist for eight months. The result was so satisfactory that I immediately adopted the principle in all cases requiring extensive tooth movement.

In conjunction with this technic, I recommend the continued use of a rubber dumbbell or exerciser, on which the patient masticates ten times on each tooth after each meal.

The mechanical stimulation of circulation of the blood to the peridental membrane is thereby controlled and pain incident to tooth movement is eliminated. I do not know of any absorption of roots in my practice when these principles have been utilized, and I am confident that its absence is due to this specialized functional exercise, together with a continued movement of a tooth in a given direction.

The application of this principle in bilateral and unilateral cases with protrusion and retrusion of incisors is illustrated in Figures 1-3.

After the gross movement has been accomplished I adopt one of the light spring appliance designs to complete rotation and alinement of the arches.

WAX AND INVESTING*

By L. B. MORRIS, D.D.S., Denver, Colorado

TO paraphrase Ruskin: "The truth must have revealed itself to Taggart in proportion to his patience and knowledge, discovered itself kindly to his pleading and led him, as it was discovered, into deeper truths."

The promised improvement by faithful research workers has, in every instance, failed of realization in practice. In justice to our patients, we must for the present acclaim Taggart as the master, and seek a better understanding of his life's work. Precise knowledge of the Taggart technic is now imperative as has been revealed by the increasing use of radiograms by careful technicians in detecting imperfections in recently inserted cast gold inlays.

It is my experience and profound belief that accuracy is in direct ratio to adherence to the original technic. The wider the deviation from the original, the poorer the results. All heralded and often widely accepted improvements have been nothing more nor less than a nearer approach to the original. A different label does not alter the fact. These improvements were either rediscoveries or a conscious or unconscious reverting to basic principles as given to us by the inventor.

For each imperfection or failure, we are prone to place the blame on the accessories, while, in fact, the unhappy results so often obtained can always be traced to failure to follow the original technic. This is due either to carelessness or to failure to understand the physical facts involved in the process; and these basic physical facts, in my observation, have never been transcended.

Regardless of the claim, it has never, to my knowledge, been demonstrated that the fundamental principles have ever been improved. The fact that hosts of other men, have, as I, for nineteen years earnestly endeavored to improve the process, should stand as an exceptional tribute to the scientific genius of the inventor. Those who claim to have improved the technic make their bow to the profession and, in what seems mock modesty, imply that the original process was a crude conception, but it has remained to their genius to refine the technic. The close followers of the Taggart technic never fail to detect the fallacy of such claims.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

*The papers of Drs. Morris and Gates, together with a paper by W. D. N. Moore, published in the November issue, were presented as a symposium on "Cast Gold Inlays."

Seldom, if ever, in the history of dentistry has a process so successfully withstood attempts toward improvement.

The wax should possess the property of copying acute angles. It should be sufficiently hard at open mouth temperature to prevent distortion during removal from the cavity; capable of being added to under moisture, and sufficiently hard to allow of heavy pressure in the cavity. It should also show a minimum amount of expansion and contraction under temperature changes; carve without flaking or dragging; retain its form during the interim between the taking of the pattern and the time of investing; burn out without leaving a residue, and leave the mold unaffected.

Within the scope of my knowledge, only the Taggart wax meets these requirements.

TAKING THE WAX PATTERN

The portion of wax which is to copy the acute angles should be of uniform temperature. A cone of wax is immersed in water at about 140 F. until it becomes light green. This is removed from the water and another cone of similar size is held in the flame and the end brought to the liquid state. This is pressed against the flat end of the uniformally softened cone to which it adheres.

When the softened cone returns to the original green, we have one portion of wax in the correct state of softness for taking the pattern, while the added cone is sufficiently hard to act as a plunger.

The original cone, before immersing in the water bath, is trimmed to such wedged-shaped proportions that there will be no resistance met on the lateral walls. Thus, our first resistance is met at the gingival wall, or base of the cavity.

If there is an adjoining tooth, a suitable thin hand matrix may be inserted between the teeth extending from just gingivally to the contact point to about 1 mm. beyond the gingival bevel. This prevents the wax from flowing into the interproximal space, holding the pressure toward the cavity and permitting an accurate impression of the contact point on the proximating tooth.

The wax is forced into the cavity with all the force of the thumb and index finger. The pressure should be heavy and constant till the wax reaches open mouth temperature. This long continued heavy pressure separates the teeth, and will, when the casting is completed, give correct tightness of contact; also, we shall have the correct location of the contact point for these teeth. If such pressure is not maintained until open mouth temperature is reached, the teeth will not be sufficiently separated for tightness of contact.

To add wax to the contact, or later, flow on solder, is to make only a crude guess at the correct location and tightness of contact.

It is an immutable law of physics that wax expands when heated and contracts when cooled. The cavity is full of expanded wax, when wax is first inserted, and unless the needed pressure is maintained, there will be a discrepancy at the gingival margin, due to the contraction as the wax cools, but when the correct pressure is maintained for a sufficient time, more wax will be

forced into the cavity and will compensate for the shrinkage.

The frequent shortage at the gingival margin is, in nearly every case, due to failure to get the wax to correct position, or to shrinkage as it cools, or to both. When the entire technic is correctly employed, the frequent gingival discrepancy is never present. Our pattern should extend about 0.5 mm. beyond the gingival bevel. This gives a surplus, and when the pattern is reproduced in gold, it may be disked to symmetrical lines and will accurately register with the cavity margins.

When the cavity is correctly prepared and this technic employed, the shrinkage of the gold is of no consequence in the inlay art. I realize that this is a dogmatic statement and will not be widely accepted; nevertheless, it is a demonstrable fact. A multitude of men may declare that a certain feat cannot be accomplished, but if one man succeeds in its accomplishment, then his premise is proved, the multitude to the contrary notwithstanding.

A seemingly accurate occlusion is now obtained and the approximate surfaces fairly well contoured. When obtaining occlusion, the stress of opposing cusps depresses the wax, which, when the pressure is released, returns in some degree to its original form. This may be obviated by allowing the patient to chew on a small piece of rubber dam of medium thickness. This will shave off a sufficient quantity to compensate for the amount the wax returns to original form. By this method, the inlay, when inserted, should require no adjustment due to the usual plus conditions.

The occlusion is now carved to correct anatomic form, and the surface smoothed with cotton carrying a very small amount of oil of cajuput.

This pattern, when correctly reproduced in gold, will require no polishing and no occlusal adjustment. When occlusal polishing is required, much of the detail of the finer occlusal grooves is necessarily obliterated.

The final approximal adjustment may be done more easily after the wax has been reproduced in gold. At this stage, the casting will have a saucer-shaped depression at the contact point. Wax, being fragile, is not easily carved in the hands. The gold is now disked, the operator rounding away from the contact point, but never touching the contact, to correct anatomic form. The periphery is reduced to symmetrical lines and should register with the bevel of our cavity margins. This bevel, when correctly made, will be quite definitely marked in the casting.

The question is often raised, "Why does the gold do all its shrinking at the gingival margin?" It does not do so. The trouble starts with a wax pattern which is already short at this surface, and no subsequent procedure can correct this discrepancy. The shrinkage of gold is intermolecular and absolutely uniform. Time does not permit of presenting physical laws in support of this statement, which is quite generally refuted by the dental profession. Suffice it to say that physicists whom I consulted are a unit in declaring this to be fact.

When the accessories that I use are employed, any fault whatsoever in the inlay is always due to faulty technic,

and not to the materials used. When we do the same thing the same way every time, we shall always arrive at the same result.

An approximoclusal pattern may be removed with an exploring tine, inserted buccally or lingually to the contact point. In case of a mesioclusodistal inlay, two tines should be inserted in directly opposite positions to each other and the pattern removed without distortion. The sprue former should be inserted at the same point as was the tine for removal. Thus, neither the contact point nor the occlusal carving will be interfered with.

The size of the sprue former should be somewhat in proportion to the size of the wax pattern, varying from 14 to 20 gage. A sprue former larger than 14 gage may allow a globule of gold to drop into the sprue and block the opening, which prevents a successful casting. The length of the sprue former should in every case be three-sixteenths inch from the wax to the nearest point of the crucible former. The reasons for this length of sprue will be omitted here; suffice it to say, they are important.

The crucible former should be symmetrical. If uneven, the hot spinning gold will dash about and may cause a globule of gold to separate and block the opening leading to our mold. The sprue should be located at the lowest point in the crucible, this permitting the gold to flow easily to its destination.

Attempts have been made to raise the temperature of the wax pattern for the purpose of expansion, to counteract the contraction of the gold. For inlay restorations, the contraction of the gold, when the Taggart technic is employed, is of no consequence. Elevating the temperature releases the elasticity which is always present, and causes a marked distortion of our pattern and a corresponding misfit of our inlay.

It would appear, from all available evidence at hand, that the best results are obtained by proceeding at practically uniform temperatures when dealing with the completed wax pattern.

In the entire process of inlay restorations, the primary and chief source of error is due to faulty grinding. Even minute indentations in the cavity result in corresponding protrusions on the pattern, which is distorted on removal.

INVESTMENT MATERIAL: ITS PHYSICAL PROPERTIES

Investment material should be composed of approximately three-fourths silica, and one-fourth plaster of Paris, with the addition of a small quantity of graphite. The silica should be sufficiently refractory to resist fusing by the hot gold used in casting, and should be as free as possible from iron contamination.

Gold, at the best heat for casting, reaches the fusing point of iron (2800 F.), which will incorporate with the gold, making it sluggish. Iron also alloys with the gold, and robs it of much of its desirable qualities of malleability. The silica should be crushed, and of exceedingly fine mesh. When the silica is not of fine mesh, the investing material will fail to copy the delicate angles of the wax pattern, or if they are copies, they will be of plaster alone.

The plaster of Paris, when unprotected by the refractory silica and graphite, will not successfully resist the process of wax elimination nor the effects of the molten gold. The round or uncrushed globules of silica used by

most manufacturers of investment material present a bland surface to the plaster of Paris, which is the binder, and lessen its resistance to distortion in the process of wax elimination, and also the internal pressure necessary to successful casting; while the acute angles of the crushed variety present surfaces to which the plaster crystals readily and firmly attach themselves, and furnish a bond which will successfully resist distortion during all stages of the process.

Plaster, which is at present the best available material to use as the binder, is readily broken down and distorted by the high temperatures necessary in the casting process; but when the minimum quantity which will successfully bind the mass together is used, the refractory silica and graphite will afford ample protection to the plaster and prevent distortion of our mold.

The use of coarse uncrushed silica is likely to be deceptive. It will offer greater resistance to the passage of a knife blade when attempts are made to cut it, and may also offer greater resistance to a crushing force; but it will not so successfully resist distortion as does the Taggart investment. The latter possesses an ample margin of safety in the wax elimination and pressure necessary in casting, and will not change its form as do all other investments with which I am familiar.

Silica possessing the desirable qualities is not uniformally obtained in the open market. This should be obtained and selected from quarries which are known to produce the most refractory variety, and should also possess the greatest freedom from iron contamination. The various grades of silica possess a wide range of resistance to fusing. That which is purchased at random invariably contains large quantities of the low fusing variety, which becomes liquid under the influence of the molten gold. This interferes with the accuracy so desired and necessary to the fit of the inlay. The use of a correctly balanced investment, and ability to follow the technic, are imperative.

TECHNIC OF INVESTING

To attain the highest degree of perfection, the following equipment is necessary: 1. A large rubber bowl as free as possible from acute inside angles. This should be used only for mixing investment. 2. A hard rubber spatula thick in the middle and thin on the edges, and curved to follow the contour of the bowl.

To prevent too rapid setting of our mass, the bowl should be thoroughly cleansed by friction. This is necessary to remove the last traces of set plaster remaining from a previous mix. Set plaster, in quantities macroscopically invisible, will unduly hasten the setting of the mix, thus robbing us of much of the time necessary to carry the investing process to a successful conclusion.

Should the water in a given locality contain undue quantities of foreign matter, for example, sodium chlorid, distilled water should be used. The temperature of the water is also an important factor in determining the rapidity of setting. The higher the temperature, the more rapid the setting; and, inversely, the lower the temperature, the slower the setting.

The setting time is in direct ratio to the temperature of the water and the freedom from set plaster. A clean bowl, and water at about 50 F., will provide ample time to complete the technic described below. The materials

furnished us should not be blamed when our results do not measure up to our ideals. The embarrassment can invariably be traced to our faulty technic.

Each box of investment contains a balance and fulcrum. With this, the correct proportion of water to powder is easily obtained, insuring uniform results as far as the mix is concerned. When the setting time is fixed by using a clean bowl, and water at about 50 F., we can obtain better results by using a 60-grain weight in the depression on the water end of the balance. I use a steel ball bearing. Lessening of the water content produces a denser mold and tends to prevent the liquid gold from entering the surface of the mold and producing a rough casting. Authority for weighting the balance is contained in the instructions on the box.

The correct proportion of water to investment is now obtained and transferred to the mixing bowl. The bowl is held in the palm of the left hand and constantly rotated with the fingers, while the right hand uses the rubber spatula vigorously, sweeping it to and fro. This should be continued for a minute and fifteen seconds. At the expiration of this time, there should remain no unsaturated particles of powder.

Before describing the method of applying investment, we will discuss the condition of the mold which is necessary for the attainment of the desired result.

Surrounding the wax pattern for the depth of about 1 mm., we should have a marked degree of density in our investment. This is necessary in order to prevent the gold from entering the surface of the mold; while, throughout the mass of the investment, there should be a considerable degree of porosity. The investment immediately surrounding the pattern we may call the filter coat. The thinness of this coating allows ready passage of air used in the casting and its density prevents the gold from entering the surface of the mold.

Roughness of the casting is always due to a degree of porosity which permits the gold to enter the surface of the mold, resulting in enlarging our casting, and causing a corresponding misfit. When the proper technic is employed, the filter coat will be impervious to gold, but will readily permit the passage of air; which results in a casting that is an accurate reproduction of the wax pattern. The technic employed to bring about the desired result is as follows: With a small sable brush, the surface of the investment is skimmed, and thus the finest particles are picked up. The coating of investment is carefully painted on the pattern, being worked into the angles in such a manner as to prevent the trapping of air. After the first coating has been applied, a delay of about one minute will cause the water that is not necessary to bring about crystallization to be dissipated into the surrounding atmosphere. This will produce a much denser surface in proximity to our pattern than would otherwise be obtained. Another coating of investment is now applied to the first, being touched against the initial coating and not painted on it. Painting or friction upon the initial coat will disturb it.

After the second coating has been applied, a total of about 1 mm. of investment covers our pattern. Again, a delay of about one minute will produce a condition of density as above

described. We now delay until the investment in the bowl has reached the stage of crystallization at which it will not pour readily. There should be a sufficient stiffness so that the pinching together of the sides of the bowl and tapping of the upper surface with the fingers will become necessary to assist the flow of the investment into the flask.

The investment should flow down the side of the flask, across the bottom and up around the pattern, this preventing trapping of air. Should the investment be poured before crystallization has advanced to the degree above described, the free water will attack the filter coat, breaking it up, and will doubtless result in a roughness of the casting. A corresponding result may be arrived at in another way, and I think perhaps in a manner more certain for the majority of dentists.

This method is to apply the first coating as already described, and hold the pattern in the path of a rather forcible stream of compressed air. This explodes any bubbles which may be present and produces a marked degree of density. The second coating is now touched (not painted) on and held in a much softer stream of air until the glint of the water has disappeared, this resulting in a dull or etched appearance of the investment.

Immediately after the glint of the water has disappeared, the investment should be removed from the compressed air; for if it is left in too long, water, which is necessary to the crystallization of plaster, will be extracted. Previously to discontinuing the stream of air, the surface tension of the water has caused the investment to pull away from the thin margins of the wax pattern.

We now do what we call rimming; that is, touching a portion of the investment to the thin edges of our wax pattern, uniting the occlusal and cavity portions of the investment. The excess water, having been removed from the occlusal and cavity surfaces, the rimming portion will now readily remain in position.

This should be held in a soft stream of air for a period of about twenty seconds, or until the glint disappears. The pouring of the investment should now be delayed until crystallization has advanced to the stage above described. The investment may now be poured just as described in the technic in which the compressed air is not used. When this has been correctly done, we shall have a marked degree of density of about 1 mm. in thickness about our wax pattern; and the balance of the investment, from which the water has not been extracted, will furnish the desired degree of porosity to permit the free passage of air necessary to successful casting.

The dense coating close about the pattern acts in a manner corresponding to a water filter, which permits the water to pass through, but does not permit the passage of a foreign substance.

The air necessary for casting will readily pass through this filter coat, for the reason that it is only about 1 mm. in thickness, but does not permit the gold to follow, and thus we may expect and obtain an accurate reproduction of our wax pattern, free from nodules and roughness. The use of the compressed air is merely another method of arriving at the result which the inventor intended should be attained.

CEMENTING INLAYS*

By M. A. GATES, D.D.S., Fort Collins, Colorado

THIS paper is confined to the cement and the technic which has to do with the cementation of the cast gold inlay.

The facts here given make up the sum of knowledge gained through observation in practice, and from information gleaned from those having a wide knowledge of the subject.

CEMENTING THE GOLD INLAY

The technic to be followed in the cementation of a cast gold inlay is of far greater importance than is generally realized, if we are to judge by the amount of literature to be found concerning this subject. It seems impossible to overestimate the value that can be placed on this part of the inlay technic.

Let us call to mind—and I am sure we have all had the experience—an inlay which, on being tried, has met with every requirement: good form and contact; correct margins; good frictional resistance on cavity walls, and perfect occlusion. Yet this same inlay, after being cemented to place, with margins stoned and burnished, has fallen short of our anticipations. The occlusion may be a bit high; and, on a close examination, there appears the thing that destroys its value as an inlay; or we may say, makes it cease to be an inlay: a cement line. Is it a discrepancy that would not show up until cementation? No; the cause of the failure is to be found, not in the inlay, but in the cement mix. Our lack of success is due to failure to make a retarded cement mix; the sole cause of many gold inlay failures.

Failure to make such a mix means that the necessary time has not been given for the seating of the inlay and the proper arrangement of the cement crystals, nor the necessary time for squeezing out the redundant cement; also, that the attempted "pinching off" of the cement line by stoning and burnishing of margins has been defeated by this too rapidly crystallizing cement. Of course, with a nonretarded mix, the inlay may have been seated, which would allow of no visible failure, but still sufficient time has not been given for the proper stoning and burnishing of margins and the arrangement of cement crystals.

The manufacturer does not produce the cement for us: he simply furnishes us with the necessary ingredients from which we are to make the cement. The quality of the mix is dependent on our technic. If a large quantity of powder is drawn into the liquid at one time and spatulated over a small area, the time of setting is greatly hastened, and a poor cement results. If this same mix is spread over a larger surface in spatulating, the time of crystallizing is correspondingly lengthened because the heat

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

generated, chemically, is more readily dissipated. We should never incorporate a large quantity of powder into the liquid at any one time; for the reaction is too violent under such conditions, producing undue heat and porosity. There is just as much resultant heat in one mix as there is in another, but the proper control and use of that heat and the dispensing of that portion of the heat which is not wanted is the main idea in the manipulation of the powder and liquid.

To produce a properly retarded cement, powder the size of a pin-head is pulled into and thoroughly spatulated with the liquid. This mixture is allowed to stand for three minutes, which is ample time for placing the napkin at the patient's mouth and accomplishing the toilet of the cavity. Let us then speak of the mix as a "retarded cement."

A retarded cement allows needed time for spatulation; dispenses with undue heat, and makes it possible to incorporate powder with the liquid, to the required degree. A retarded cement gives the time necessary for seating the inlay and for the consequent squeezing out of the redundant cement. The inlay must be seated or we lose much of the frictional resistance on the opposing walls. The strength of anchorage of an inlay is in direct ratio to the adaptation between the inlay and opposing cavity walls.

A retarded cement allows time for the forcing out of the redundant cement and for the stoning and burnishing of the margins after the inlay is tapped to place, leaving no cement line presenting itself to attrition or to the dissolving effects of saliva. The stoning and burnishing pinches off the cement and leaves a smooth margin, thus giving complete protection to the cement substance.

Some may prefer to keep at hand a slow setting cement and a medium setting cement; but in doing our own retarding, we can balance the time of setting to the room temperature. For instance, if the room temperature were about + 50 degrees F., we would retard two minutes instead of three. This would give about the same result as a three-minute retarding when ordinary room temperature obtains.

CEMENT MATERIALS

In the cementation of the cast gold inlay, it is understood that we are considering oxyphosphate of zinc and oxyphosphate of copper cements, only. The powder should be a high grade, extremely finely ground product. The liquid should be the one furnished by the manufacturer for that powder. The principal items to consider in regard to the liquid are the things which have to do with keeping it in a proper condition. It should be so handled as to give the least amount of exposure to the atmosphere. A freshly prepared liquid is safer, as long standing tends toward deterioration. The usual corked bottle in which the liquid is received is not suitable as a daily service bottle because the cork becomes liquid-soaked, and crystals form about the neck and drop into the bottle, changing the chemical balance.

The best service bottle seems to be the one with the ground glass telescoping cap. Before transferring the liquid

to this service bottle, the cap should be further fitted by "grinding in" on the bottle with fine wet emery powder; following which, both bottle and cap are, of course, thoroughly cleaned and dried. The ground glass cap takes precedence over the ground glass stopper, because it is more easily kept free of the liquid and lessens the possibility of crystals forming and dropping into the liquid, changing the specific gravity. This is also the best type of bottle for carrying a dropper; increasing the ease with which one may remove the liquid, and shortening the seconds of time the liquid is exposed to the atmosphere. It is possible to twist the cap from the bottle, stir the liquid to uniformity, and deposit it on the slab while still holding the cap in the little finger. Alteration in the specific gravity of the cement liquid may be occasioned by the addition or subtraction of water. The above mentioned dropping of crystals into the bottle will change the chemical balance of the liquid as will also the evaporation of water from the liquid when the bottle is carelessly or unnecessarily left uncapped; and any change in the chemical balance of the cement liquid will result in a loss of crushing strength. Cloudiness of the liquid indicates a change in chemical balance and necessarily unfits such liquid for use.

INSTRUMENTARIUM

The slab should be large and heavy, not less than 3 by 6 inches, and 1 inch thick. Usually the slab is too warm, and hence must be cooled to assist in retarding the crystallization of the cement. If it is cooled to the dew point, moisture will collect on the slab and become incorporated in the mix, interfering with the chemical balance. The dew point probably never reaches as high as 65 F; and as this is also a usual room temperature, it seems best to adopt a standard of 65 F., for slab temperature. The mixing temperature exercises a marked influence on the time of crystallization, and therefore on the amount of powder that can be incorporated with a given amount of liquid to a uniform consistency. Too low a temperature allows for an overloading with powder because crystallization is overretarded, while too high a temperature permits the reverse condition, or an overload of liquid. In either case, the result is diminished strength. In addition, the slab must be clean and smooth. A slab that has become scratched and pitted should not be used for this purpose. An efficient method of cleaning both slab and spatula is to place them in clean water as soon as possible and wash thoroughly, then dry with a clean towel. If there is any suspicion of either slab or spatula being greasy, they should be scrubbed with grain alcohol.

The spatula should be large and heavy, with the edges thinner than the center. The one we are using at present is 1 mm. thick in the center, tapering to 0.6 mm. near the edges. This type seems to give the greatest amount of spatulation efficiency when properly used.

As to the material from which spatulas are made, there are several that do not oxidize in the acid liquid. German silver is popular because it is cheaper: in addition, there are tantulum and stellite.

Here, we have before us the slab and spatula, powder and liquid. With the slab at + 65 F., slightly more than sufficient powder is rolled out to neutralize the amount of liquid that we intend using. It is best to use never less than 8 drops of liquid, for the reason that there must be enough cement to fill the cavity completely and cover the cavosurface of the inlay, in order to avoid the trapping of air under the inlay. (For the larger inlays, 12 drops of liquid is used.) Into this liquid is drawn the aforementioned pinhead of powder. It is thoroughly spatulated until it can be seen that this small amount of powder is uniformly distributed throughout the liquid. After this comes the wait of three minutes, which is the amount of time necessary for the proper retardation of crystallization as well as the time consumed in placing the napkin at the mouth of the patient and completing the toilet of the cavity, which is accomplished in the following manner: The cavity should be wiped dry with cotton pellets and then scrubbed with warm alcohol. This is followed by a few blasts of warm air to bring the dentin to normal dryness. As mentioned above, in using this method of handling the cement, a standard temperature of 65 F. for the slab seems best. Different degrees of setting could be obtained by the raising or lowering of the temperature of the slab, but this is not advisable because, when the dew-point is reached, moisture collects on the slab and becomes incorporated with the mix. This moisture would further retard the crystallization and would not be constant in amount. The best cements, as prepared for dental operations, are made hydraulic to the correct degree. The necessary water is incorporated in the liquid, and this ratio should be neither increased nor decreased. When placed in the mouth, cement is constantly surrounded by moisture, and therefore cannot dry out.

Acceleration of crystallization weakens the cement, while proper retardation assists in giving us the maximum of strength obtainable. Into the retarded liquid should be drawn powder equal to about one fourth of the bulk of liquid. This is spatulated until the mix is smooth and uniform, with no powder lying around the edges unmixed. The mix should all be scraped up from time to time and the spatula rolled over two or three times while held tightly on the slab. This makes for a uniform mix and leaves no free powder nor partially incorporated powder around the edges. The mix is always spread over a sufficiently large area to allow for the whole mass to be spread in a thin layer on the slab. The necessity of this is as follows:

1. The spreading over a large area diffuses the heat generated by the chemical action of powder and liquid, it being dissipated into the air and the cool slab.

2. It permits us to bring the mix under heavy pressure, thus thoroughly incorporating all powder grains with the liquid. The excess heat above mentioned will readily escape from the surface of this thin layer, and must do so to maintain our mix in a retarded state.

The mixing of the cement is a neutralizing process. The incorporation of the powder and liquid must be complete. This demands a large slab and large spatula, and heavy pressure. Smaller portions of powder are added to the mix from time to time, and each,

in turn, thoroughly spatulated as before. The free liquid is about all completely neutralized when a mix, containing not less than 8 drops of liquid, is scraped up and will just drip slowly from the end of the spatula when held perpendicular.

This does not produce a thin cement, but a retarded cement. More powder can be incorporated in a given amount of liquid by this method than by the usual method. All good dental cements are so balanced that the best results are obtained when the cement is constantly surrounded by moisture. Facings cemented onto bridges, with the cement allowed to dry out, before placing in the mouth, show a marked tendency to loosen. The addition of phosphoric acid in the zinc oxid powder does not make an amorphous mixture. The zinc oxid is composed of hard crystals, which wedge between the gold inlay and the cavity walls, and this gives us another reason for using only a fine vitreous powder. The only change which the incorporation of phosphoric acid brings about is the formation of additional crystals.

The best cements have a slight expansion of the mass during crystallization which is known as growing crystals. When the inlay is finally driven to its seat, it is wedged and held there by the zinc oxid crystals. During the setting time of the cement, these crystals continue to grow and wedge the inlay more securely into place. The maximum wedging force of these crystals is obtained only when the inlay correctly makes contact with the cavity walls.

The toilet of the cavity has been previously completed, as mentioned above, the operator keeping in mind the fact that the dentin should be normally dry. With a small stiff instrument, like a curved root canal plugger, a small amount of cement is carried into the angles, and all surfaces of the cavity are carefully lined, the operator being certain that no air is trapped under the cement. More than ordinary care should be used here to prevent the trapping of air between inlay and cavity walls. Any air so trapped is enormously compressible, and when so trapped not only tends to lift the inlay from its seat, but also takes up space that should be occupied by cement. Now a larger instrument is used and the cavity filled up. Cement is worked over the entire cavosurface of the inlay, and as the latter is carried to the tooth, it will be noticed that the immediate union of the redundant cement on the inlay with that in the cavity precludes any possibility of trapping air as the inlay is slowly forced to place with a rocking motion and finally seated by tapping with the mallet, a pine stick being employed against the inlay to transmit the blow. When an inlay does not make proper contact with the cavity walls, there remains so much cement between cavity walls and inlay that the latter must necessarily be forcibly held to place by the operator until the cement is in an advanced stage of crystallization. This is unnecessary. The inlay should fit the cavity accurately so that by tapping with the mallet, the surface tension of the cement will be overcome, and the cement will be reduced to its ultimate crystals. In this manner, we take advantage of the maximum wedging force of the cement crystals, because the expansion of the mass, as the crystals grow, compresses the dentin; thus giving us additional anchorage and

compensating for the coefficient of expansion and contraction, between the tooth structure and the metal, due to thermal changes.

There are three conditions under which an inlay will rebound under mallet force:

1. If it does not correctly fit the cavity, leaving an undue amount of cement between the inlay and cavity walls.

2. If the mallet force is not sufficient to overcome the surface tension of the cement, and seat the inlay.

3. If there is trapping of air between cavity walls and inlay.

Any of these conditions will necessitate the operator holding the inlay in place until the cement is crystallized. An inlay which must be held to its seat by the operator does not attain the ideal. In other words, mallet force must be used, and an inlay which rebounds under these blows should be removed and the fault or faults corrected.

This mallet force has not only seated the inlay, but also has necessarily squeezed out the redundant cement. The surplus cement is valuable in carrying away any uncontrollable moisture which may have accumulated at the gingival margin, owing to weeping of the tissues. The margins are now burnished down tightly, cutting off the cement line and sealing the cement against any subjection to attrition or dissolution by salivary action. This portion of our technic is made possible by the retardation of crystallization.

The inlay should now be left undisturbed for about six minutes. The redundant cement is removed and any further finishing which may seem necessary is done at a subsequent sitting.

THE HISTORY OF DENTISTRY IN GREAT BRITAIN*

By LEONARD MATHESON and J. LEWIN PAYNE, London, England

For out of olde feldes, as men seith,
Cometh all this new corn fro yere to yere;
And out of olde books, in good feith,
Cometh al this newe science that men lere.
Geoffrey Chaucer.

EARLY HISTORY

THE early history of British dentistry is not easy to unravel, for there are few references to the subject in English literature before the eighteenth century; and we do not propose to give space to more than an outline of that remote period.

In the days of ancient Britain, it is generally agreed, such treatment of the teeth as was demanded was supplied by the Druids, and it consisted chiefly of incantations and the use of substances supposed to possess magic properties.

A little later, the art of dentistry was practiced, in a crude sort of fashion, by priests and monks, and when the laity became interested in surgery, it was carried on by barbers and traveling charlatans, who were in the habit of attending fairs. Very often, they employed music to attract attention to their grim performances, and perhaps also for the purpose of drowning the cries of their victims.

In addition, some of the surgeons treated the teeth as part of their calling. References to this branch of the healing art may be found among primitive writers, but the treatment they described consisted largely in the employment of drugs. These very early practitioners were not in favor of extracting teeth except as a last resort, and the patient was usually placed in the horizontal position when these clumsy operations were attempted. John Arderne, of Newark (1412), who has been described as the father of English surgery, regarded the operation of extracting teeth as "very dangerous."

BARBER SURGEONS

In 1376, "tooth drawing" is mentioned in a memorandum of the Barber Surgeons Company, and in the records of this company, references can be found concerning the admission of "tooth drawers" to its membership. The Company received its charter in 1462.

The barber surgeons were divided into two groups: (*a*) those who practiced surgery, and (*b*) those who practiced "barbery," i.e., blood letting, tooth drawing, etc. The tooth drawers, for the most part, were men of little education, and occupied a low status in

*Read before the Section on History, Science and Libraries at the Seventh International Dental Congress, Aug. 25, 1926.

society. They wore a distinctive garb as was common with other craftsmen, and oftimes the costume was fantastic, consisting of fur-trimmed robes and oriental turbans, or a cap on which a brooch trimmed with teeth was clipped. A string of teeth might have been seen around the neck, or on a girdle round the waist.

Thus, in the sixteenth century, dentistry was but a desultory trade, which could be learned through an apprenticeship system, but without the aid of literature to guide the student in his work.

It was after this period that practitioners of the healing art began to devote themselves to special branches of medicine and surgery, and dentistry was at last seriously cultivated by a certain small number of medical practitioners.

FIRST BRITISH BOOK ON DENTISTRY

Charles Allen, of Dublin, is reputed to have been the first to write a book in English which was devoted to the study of dentistry. The book was published in Dublin in 1686. It was called "The Operator for the Teeth." In the following year, it reappeared under the title of "Curious Observations on that difficult part of Chirurgery Relating to the Teeth." The book is a rare example of printing in Dublin during the seventeenth century. Allen describes the form and structure of the teeth as then understood, and he explains the use of the "polican," which he considers the best instrument for the drawing of teeth. He refers to the operation of transplantation, which his master, a man named Bannister, performed with success; but he himself condemns the operation as being an example of "robbing Peter to pay Paul."

In 1742, Joseph Hurlock, a surgeon, published a book entitled "A Practical Treatise upon Dentition, or the Breeding of Teeth in Children." It was written in Coleman Street, in the City of London.

Mrs. Lillian Lindsay, who has made some very valuable contributions to the history of dentistry, is of the opinion that modern dentistry is not an offshoot from the guild of barbers and barber surgeons, but rather that it had a humble origin in the "tooth drawer" of early times, through the "operator for the teeth" of the eighteenth century, to the dentist of the nineteenth.

EIGHTEENTH CENTURY—RACQUET COURT

She has given an interesting account of the history of the practice which commenced at No. 1 Racquet Court, Fleet Street, London, in 1701, when John Watts moved there from Bride Lane, to carry on his practice as a dentist. Watts was joined by Samuel Rutter in 1723, and the former's name disappeared from that house in 1742, when Rutter took over the full responsibility. William Green came into the practice in 1744, and three years later, Samuel Rutter, having held the post of junior warden, was appointed master of the Barber Surgeons Company. Later on, William Green, was appointed "operator for the teeth" to King George the Second.

THOMAS BERDMORE

Thomas Berdmore became an apprentice to Green and Rutter at Racquet Court, and he succeeded the

former in 1766, at the early age of 26, in holding the royal appointment.

Some authorities have stated that Berdmore's was the first royal dental appointment made in England. This is an error: Green and the two Hemets, (father and son) held this post before him.

In 1768, Berdmore published his treatise on "The Disorders and Deformities of the Teeth and Gums," and at that time, it was the only English textbook which dealt with dental surgery as a whole. It was conceived and written in a truly scientific spirit. The book contains the first reference in English literature to the use of the microscope for investigating the minute structure of the teeth. It was translated into several foreign languages, and its value may be gathered from the fact that the last edition, published in Baltimore, Md., appeared in the year 1844, seventy-six years after its first publication.

Berdmore made considerable improvements in the methods of construction and adaptation of artificial teeth. Metal work for dentures was usually carried out by goldsmiths, and plates made of ivory and bone also were carved by them. Natural teeth were mounted upon bases made of walrus or hippopotamus ivory, or upon bone or gold.

Berdmore was succeeded by James Parkinson, the progenitor of a well-known family of dentists. His son, George H. Parkinson, joined the practice in Racquet Court in 1800 and was in practice there until 1852, when he was succeeded by his two sons.

In this remarkable series of practitioners, following each other in connected succession, we find the first definite evidence of dentistry's being followed as an acknowledged calling of repute. James Spence became "operator for the teeth" to King George the Third, and was Berdmore's contemporary on the royal household staff from 1767. The word "dentist," it may be remarked, was taken from the French, and as early as 1622, it is recorded that Arnauld Gilles and others in France were called *chirurgiens dentistes*. Scornful references to the use of the term "dentist" are to be found in the English literature of the eighteenth century, and both Rutter and Berdmore preferred to be known as "operators for the teeth." In Great Britain, the term "dentist" did not meet with approval, and we find the *Edinburgh Chronicle* for 1758 stating that the word dentist "may be well enough for a French puffer, but we fancy Rutter is content with being called a 'tooth drawer.' "

WOOFFENDALE AT NEW YORK

Robert Wooffendale, a pupil of Thomas Berdmore, emigrated to New York City in October, 1766. It is generally stated that he was the first properly trained dentist to practice the art in the American Colonies. He practiced first of all in New York City, and later in Philadelphia.

It is said that he returned to Liverpool in 1768, and later to Dover Street, Piccadilly, in London, in 1792, but we find him back again in New York in the year 1795. Wooffendale is reputed to have constructed the first full set

of artificial teeth made in America. He was one of the earliest dentists to attempt the treatment of the dental pulp. He was proud of his association with Berdmore, to whom he refers in his little book entitled "Practical Observations on the Human Teeth" (London, 1783).

JOHN HUNTER

In 1771, John Hunter, who was surgeon to St. George's Hospital, published his classic work on "The Natural History of the Teeth." This book exercised a great influence in drawing attention to dentistry as an important branch of surgical practice. It owed its great and enduring reputation not only to the authority of the great anatomist, but also to the intrinsic value of its beautifully executed drawings, its masterly grasp of differentiating characteristics of the teeth and its descriptions couched in language as clear as it is forcible.

WILLIAM RAE'S LECTURES

The first regular series of lectures on dentistry in Great Britain was delivered by William Rae. William was the son of James Rae, a surgeon practicing in Edinburgh. He came to London in 1773 and started in practice as a dentist, and it is thought that he became associated with John Hunter and learned much from him. The lectures were delivered in 1782. Afterwards, he became dentist to King George the Third. Joseph Fox, the first dental surgeon appointed to Guy's Hospital, to whom we shall refer later, succeeded Rae in his practice.

Bartholomew Ruspini, a surgeon-dentist living in Pall Mall, wrote a "Treatise on the Teeth." He was not ashamed to advertise himself and his skill, and he makes frequent references to a particular tincture which he alone was able to supply. There seems to be sufficient evidence to prove that Lord Nelson, when but a captain in the Navy, became a patient of Ruspini, who removed a fibroma from his gum.

ROBERT BLAKE

Robert Blake wrote "Essays on the Structure and Formation of Teeth" in 1798, and this was quickly followed in 1803 by a textbook under the same title as that of John Hunter's, by Joseph Fox. These, with Thomas Berdmore's work, were almost the only reliable British textbooks on dental anatomy and surgery published in England 100 years ago.

James Snell, in his "Practical Guide to Operations on the Teeth" (1831), refers to the discoveries toward the close of the sixteenth century of Copernicus of Poland, of Galileo in Italy and of Francis Bacon in England, and shows how their work opened the eyes of men to the value of methods of experiment and induction in prosecuting the study of physical philosophy.

NINETEENTH CENTURY DEVELOPMENT

As we have endeavored to show, at the close of the eighteenth and during the early part of the nineteenth century those who practiced dentistry in this country were for the most part uneducated men. Charlatanism, the offspring of ignorance and presumption, was rampant. Blatant advertisements extolling the skill of the dentist to the exclusion of all his fellow practitioners

were common. It was not considered unethical to issue notices in the public press, nor to publish pamphlets setting forth the wonderful ability of the authors, and the fascinatingly low fees at which they were prepared to receive patients. Personal advancement by questionable, if not disreputable, methods was not confined to the lowest class of practitioners; indeed, the vast majority of the dentists of that day had no serious idea of what a profession demanded at their hands. It is true that there were a few, a very few, reputable and worthy practitioners, some of them qualified surgeons and some without any recognized qualifications, who practiced the art with credit and success; yet the overwhelming proportion of dentists at that time were mere tradesmen, and sadly lacking in all scientific knowledge. It was, indeed, almost a reproach to be a dentist.

A considerable number of persons followed this calling in the British Isles. It would be difficult to tell how many, for there were no official lists of any kind in those days. As there was no bond of union which brought together the practicing dentists, the majority carried on their practices privately, and exclusively in their own individual interests. There was no journal to represent the views of those engaged in this important branch of surgery. If any one desired to make known some new fact, he was obliged to do so through the columns of the medical press. English dentists of that day were a long way behind their French confrères and, apparently, were not familiar with the writings of Pierre Fauchard (1728).

GEORGE WAITE'S "APPEAL"

The first definite step toward dental reform in this country was taken by George Waite, a member of the Royal College of Surgeons, who, in 1841, issued "An appeal to the Parliament, the Medical Profession, and the Public, on the present state of Dental Surgery." He was a dentist of repute, both in England and abroad; and Parmley, a well-known American dentist of that period, spoke in glowing terms of his beautiful gold fillings, the like of which he had not before seen.

George Waite urged the necessity of recognizing dentistry as a legitimate branch of medicine, and he suggested that the College of Surgeons nominate a board from the dental members of the college, which might issue diplomas to those dentists who showed competence at an examination. This appeal voiced a desire for reform, which was felt very strongly among some of the most eminent practitioners of dentistry, but there was not enough enthusiasm among them to secure any organized effort, and nearly twenty years passed before this reform was achieved.

During the following year (1842), James Robinson, who, at a later period, took a leading part in the formation of the College of Dentists, and also in the foundation of the National Dental Hospital (1861), endeavored to form a dental society, but the scheme was abandoned.

JOINT APPEAL TO ROYAL COLLEGE OF SURGEONS

March 4, 1843, while a bill affecting the medical profession was before Parliament, a meeting was called at the house of Arnold Rogers, in Regent Street, to consider the claims of den-

tists. Robert Nasmyth, John Tomes, Edwin Saunders and others attended, and Arnold Rogers occupied the chair. It was decided, at this meeting, to inquire of the president of the Royal College of Surgeons of England as to whether the bill before Parliament had any reference to dental practice, and, if not, whether it could be so amended as to include dentists in its provisions.

The president of the Royal College of Surgeons, Anthony White, was interviewed, but he was not very encouraging either in his remarks or in his reply to the deputation, and he described as "seceders" those members of the college who practiced dentistry exclusively.

Further meetings were held and petitions were presented both to the president and council of the Royal College of Surgeons and to the secretary of state for the Home Department, who had charge of the medical bill. But, in spite of several valiant efforts by those high-minded practitioners, for more than ten years little was accomplished toward redeeming dentistry from its unsatisfactory position.

FIRST EUROPEAN DENTAL PERIODICALS

Failing in his efforts to form a dental society, James Robinson, in 1843, started the first periodical published in Europe which was devoted exclusively to dental surgery. It was entitled *The Quarterly Journal of Dental Science.* This journal had a short life. It was followed by another publication called *The Forceps*, which appeared from 1844 to 1845.

SIR JOHN TOMES

In 1847, John Tomes completed the publication in the *Medical Gazette* of his lectures on "Dental Physiology and Surgery," which had been delivered at the Middlesex Hospital Medical School in the year 1845. This work was perhaps the most important matter affecting the profession for the next few years. Tomes was a man of extraordinary ability and energy. Revered throughout the world wherever dentistry was practiced, he was the guiding spirit that inspired the dental reforms of the last century. He devoted his life to the science and practice of dental surgery, and to him perhaps more than to anyone else we owe the placing of our profession on a sound and scientific educational basis. He was knighted in 1886. Dr. Geist-Jacobi, in writing of him, says "He was the most renowned dentist of the nineteenth century, a man who belonged to the whole

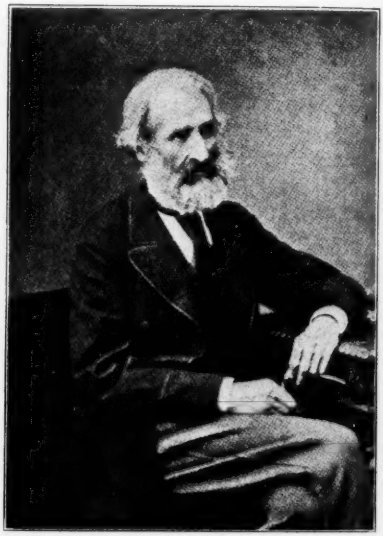


Fig. 1.—Sir John Tomes, F.R.S., F.R.C.S., Eng.

civilized world and not to any one particular nation." He died in 1895.

SAMUEL LEE RYMER

Aug. 25, 1855, there came from Samuel Lee Rymer of Croydon, then a young man of courage, skill and zeal, a letter which was published in the pages of *The Lancet*. He described the chaotic conditions which marked the practice of dentistry and appealed for the

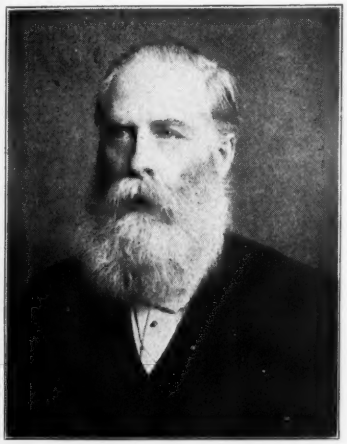


Fig. 2.—Samuel Lee Rymer.

foundation of an independent "college of dental surgery."

The letter created a fresh interest in dental reform, and, after using the columns of *The British Journal of Dental Science* to carry on his propaganda, Rymer called a meeting at the London Tavern, Bishopsgate Street, E.C., September 22, 1856, to consider what should be done. This was an important date in the history of British dentistry, for it was the first occasion on which all members of the profession had been invited to meet together, and about 200 dentists attended. Resolutions were passed calling for the organization of a dental society and the establishment of some system of professional education and examination. A committee was then appointed to carry these resolutions into effect.

In the meantime, the gentlemen who first approached the Royal College of Surgeons with a memorial in 1843 had not been idle, and in November, 1855, a meeting was convened for the purpose of founding a society on an equality with other learned societies.

While this question was under consideration, it was decided to memorialize the Royal College of Surgeons once more on the necessity of establishing a recognized dental qualification. In this second memorial, it was urged that some special qualification in dentistry was required. Although a few of those who practiced dentistry had obtained medical qualifications, the memorialists explained that a strictly medical or surgical degree could not, in itself, prove that the possessor was familiar with the practice of dental surgery. They petitioned for a course of education, to be followed by an examination in the department of dental surgery on similar lines to that of midwifery.

THE ODONTOLOGICAL SOCIETY OF LONDON

This second memorial was signed by eighteen of the leading dental practitioners of that day, and it was presented to the president of the council of the Royal College of Surgeons, Dec. 11, 1855. While the matter was in abeyance, the memorialists met at the house of Samuel Cartwright, Sr., 32, Old Burlington Street, W., Oct. 27, 1856, and again, Nov. 10, 1856, when they duly constituted themselves "The Odon-

tological Society of London," a society for the encouragement of a knowledge of dental surgery. The by-laws were founded upon those of the Pathological Society and other learned societies. The following officers were appointed: president, Samuel Cartwright, F.R.S.; vice-presidents: John H. Parkinson, and Arnold Rogers; treasurer: Edwin Saunders; honorary secretaries: Samuel Cartwright, Jr., John Tomes and Thomas A. Rogers.

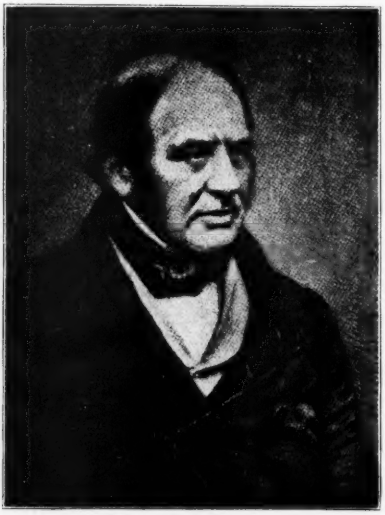


Fig. 3.—Samuel Cartwright, F.R.S., first president of the Odontological Society of London.

Thus, a struggle had been in progress during the year 1856 between the memorialists (as they were called), who continued their methods of privacy, and the party led by Samuel Lee Rymer, which invited the cooperation of all those who were practicing dental surgery in the country, and which was in favor of establishing an independent college that should grant its own diploma.

The fact that some of those who were among the most influential members of the profession did not act in unison with the great bulk of practitioners led to resentment on the part of the latter. These feelings were accentuated when, at the second meeting for the organization of the profession, Tuesday, Nov. 11, 1856, it was discovered that the Odontological Society had been constituted on the previous day.

Monday, Jan. 5, 1857, a small number, less than fifty members, assembled in a room at 32A, George Street, Hanover Square, W., to listen to the inaugural address of Samuel Cartwright, Sr., the first President of the Odontological Society of London (as it then was called). Samuel Cartwright held no medical qualifications, neither had he any dental diploma, as these were days before the licentiateship in dental surgery was instituted, but he possessed the higher distinction of being a fellow of the royal society. After the meeting, the members adjourned to the house of Edwin Saunders, at 13A, George Street, Hanover Square, for a *conversazione*.

From these small beginnings, the Odontological Society began to enroll the best and most distinguished members of the dental profession.

Two items of interest in connection with the early years of the Odontological Society may be noted. One was the engraving of a diploma for presentation to the honorary members of the society; and the other was the share taken by the society in the memorial to John Hunter, which was erected over the grave at Westminster Abbey after

his body had been reinterred there. A sum of £50 was contributed by the society toward this memorial. Both these events occurred during the year 1859.

THE COLLEGE OF DENTISTS INAUGURATED

In the meantime, and as a result of the meetings called by Samuel Rymer, "The College of Dentists in England" had been founded, under the presidency of James Robinson, with Charles James Fox, Alfred Hill and Samuel Lee Rymer as honorary secretaries.

The inaugural meeting of the college was held at the Hanover Square Rooms, Feb. 14, 1857, about five weeks after the first general meeting of the Odontological Society. To that meeting, members of the Odontological Society were invited, and cards of invitation were sent to S. Cartwright, Jr., one of the honorary secretaries, for distribution among the members. But Cartwright returned the cards stating that the secretaries had not been authorized to issue them. This appears to have been done without consulting the President of the Odontological Society or Council, and naturally it caused some ill feeling among the members of the College of Dentists of England.

It would not be profitable to go into the various events and the somewhat acrimonious discussions which followed between these two parties; but this at least can be said: both quite sincerely believed that they were working for the best possible results; both parties were very much in earnest and had the future of our profession at heart. It is enough that the dreams of these pioneers have come true.

Although the Royal College of Surgeons had been petitioned thrice before the end of 1856, they sent no official reply, and, in February, 1857, it was decided to appeal once again to the president and council. It was not that the college authorities were entirely unsympathetic with the aspirations and ideals of the memorialists, although a large proportion of dental practitioners thought otherwise, and this view has been suggested by Alfred Hill in his "Reform in the Dental Profession." In the early stages, no doubt, some members of the council of the Royal College felt reluctant to take on themselves the responsibility for a specialty which at that time was of small repute and little appreciated, and for the acquirement of which no recognized educational system existed. The real difficulty was explained in a reply dated March 13, 1857, from Edmond Belfour, the secretary. It consisted in this, that the council of the College of Surgeons had not the power to institute a special examination in dental surgery without the authority of a supplemental charter; and the council thought it would be better if the Odontological Society made a direct appeal to Parliament to be placed, either independently, or in connection with the college, under the supervision of the general council proposed in a bill which was being promoted by the various medical corporations.

The correspondence between the Odontological Society and the Royal College of Surgeons continued. The Odontological Society undertook to

draw up a curriculum suitable for a license in dental surgery. The society disagreed with the suggestion of the Royal College that the examination of practitioners of dental surgery should be the same as that required for the membership of the college, because that meant that a dentist would be obliged to spend more time over his education

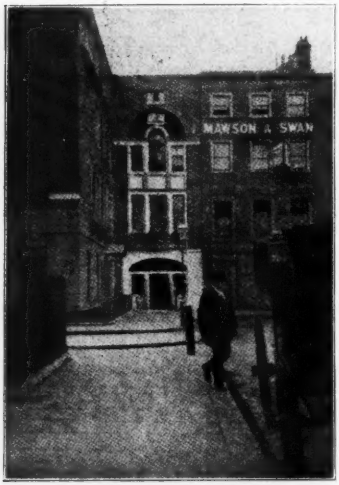


Fig. 4.—Dental Hospital and London School of Dentistry, Soho Square.

than would the medical practitioner. They suggested a course of education extending over four or five years, and an examination which was not to be inferior to that of medicine. It was to be different in kind but not in degree.

In order to carry out the special training necessary for a dental practitioner, some new provisions had to be made, and so the council of the Odontological Society appointed a committee for the organization of a dental hospital and a school of dental surgery.

DENTAL HOSPITAL AND SCHOOL OPENED IN SOHO SQUARE

This organization involved a large amount of energy, and some of the members of the committee were indefatigable in their efforts. After a few months' strenuous work, the Dental Hospital and London School of Dentistry was opened, in Soho Square, Nov. 1, 1858. The building chosen for the purpose was No. 32, a quiet house in the southwest corner of the square. Here, the work of the first dental hospital of London was begun, and was carried on for nearly sixteen years. The house stands there today, having suffered little alteration to its frontage during the last hundred years. Formerly, it was occupied by Sir Joseph Banks (1744-1820), the great naturalist, and president of the Royal Society.

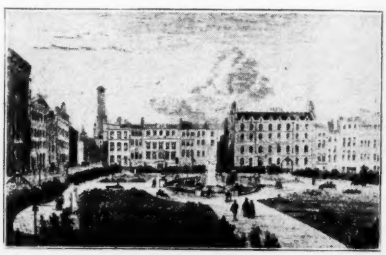


Fig. 5.—General view of Leicester Square, showing Dental Hospital of London (1871).

The Odontological Society, which had held its general meetings from the outset in the rooms of the Medical Society of London, at 32A, George Street, hereafter made the new dental hospital its headquarters, and the first time it met in Soho Square was on Jan. 8, 1859, just two years after its inaugural meeting.

When the Dental Hospital of London, finding that the house in Soho Square was becoming too small, moved to larger premises at 40, Leicester Square, in 1874, the Odontological Society moved also, and it found in the new building much better accommodation for its library and museum, as well as a more suitable meeting room.

Twenty-five years later, the Royal Dental Hospital of London needed further accommodation, and new premises at the corner of Leicester Square were erected. Then it was that the Odontological Society severed its ties with the Hospital and moved into the premises of the Royal Medical and Chirurgical Society, 20, Hanover Square, W.

The drawing up of a curriculum for the training of dental surgeons and the founding of the first dental hospital in this country were not the only matters of importance to the profession which were undertaken by the Odontological Society during the year 1858. For the medical profession bill, which had been introduced to Parliament in 1857 but withdrawn at the end of the session, passed through all the stages and became a law in the summer of 1858, and the Society worked hard to obtain the inclusion of a clause to enable the Royal College of Surgeons of England to carry out the wishes of the memorialists.

LICENTIATESHIP IN DENTAL SURGERY ESTABLISHED

Thus, with a suitable curriculum and a dental hospital and school in which to train students, the College of Surgeons was appealed to once more, and this time the appeal was successful, for, Sept. 8, 1859, an amended charter was granted to the Royal College of Surgeons of England in the terms of the following clause:

> It shall, notwithstanding anything herein contained, be lawful for Her Majesty by Charter, to grant to the Royal College of Surgeons of England power to institute and hold examinations for the purpose of testing the fitness of persons to practise as Dentists who may be desirous of being so examined and to grant certificates of such fitness.

This clause was added to the amending bill, and it may be considered, therefore, the British dental surgeon's first charter.

March 13, 14 and 20, 1860, the first examination for the licentiateship in dental surgery was held, and forty-three men obtained the diploma. The examiners appointed by the College of Surgeons were Messrs. Arnott and Lawrence for the general subjects, and Messrs. Thomas Bell, Arnold Rogers and John Tomes for the dental subjects.

DISSOLUTION OF COLLEGE OF DENTISTS

The next important stage in the history of English Dentistry was the merging of the College of Dentists in the Odontological Society, May 4, 1863. Within a year after the formation of the College of Dentists, an attempt was made to bring the two organizations together. Thomas Underwood, who at that time was a prominent member of the College of Dentists, worked hard to achieve this result. He met John Tomes, and together they drew up an agreement which would have led to an amalgamation in 1858.

This draft agreement was supported by many of the most able and influential members of the College of Dentists, of whom James Robinson and Robert Hepburn were chief. But the antagonisms which had arisen earlier prevented this first attempt from reaching a successful issue, and when a vote was

taken at a general meeting of the college, a small majority decided against the union. After this, the College of Dentists lost ground, for Thomas Underwood and many other members of the college joined the Odontological Society and threw their influence into what had been formerly the smaller body.

After this unsuccessful attempt to settle the difference of the two parties, the College of Dentists adhered to its original intention of conducting its own teaching and granting its own diploma. So the Metropolitan School of Dental Science was formally opened at 5, Cavendish Square, Oct. 5, 1859, and B. W. Richardson delivered the inaugural address.

NATIONAL DENTAL HOSPITAL OPENED

Stimulated by the action of the Odontological Society, and mainly through the influence and energies of James Robinson, the National Dental Hospital was opened in November, 1861.

There were at this time two contending parties, each possessing a school and a hospital. Each published transactions in its own journal. But the action of the College of Dentists at its general meeting of January, 1858, in refusing to join hands with the Odontological Society, led to the secession of some of the college's most notable supporters, and Samuel Rymer's party discovered that it was losing ground, while the Odontological Society was gaining all the time. And so, in December, 1862, after an independent existence of just five years, the college approached the Odontological Society, and after formal dissolution, April 6, 1863, the majority of its members joined the society, which thenceforward was known as the Odontological Society of Great Britain. The College handed over its library, museum, furniture and such small sums as were available after the winding up.

Thus, in May, 1863, the College of Dentists ceased to be, and the differences between the two rival parties of the profession were healed in union.

The political work of the Odontological Society did not end with the establishment of a dental diploma and the amalgamation with the College of Dentists; for, while the charter had given the Royal College of Surgeons power to examine, and to grant a dental diploma, it did not provide for the registration of the L.D.S. For some years, the society agitated for this further recognition, but it remained for the Dental Reform Committee in the late seventies to bring about the desired consummation. The work of this body, to be mentioned immediately, left the Odontological Society free to devote all its energies to scientific work. In the year 1905, when steps were being taken to bring about a union of the various medical societies in London, the Odontological Society, as one of them, was invited to cooperate.

ODONTOLOGICAL SOCIETY MERGED IN ROYAL SOCIETY OF MEDICINE

As the result of these deliberations, the Royal Society of Medicine was formed in 1907, and the Odontological Society became the odontological section of that union of medical societies. The library has become a part of the largest medical library in the British Empire. The museum was removed to the Royal College of Surgeons in 1909, where it is now handsomely housed and where it has enjoyed the curatorship of Sir

Frank Colyer, who has brought its organization to a high pitch of excellence, and greatly enhanced its value by valuable monographs on many of the specimens displayed.

MANCHESTER MEETING AND DENTAL REFORM COMMITTEE

The Dental Reform Committee was the direct outcome of an enthusiastic meeting of dentists from all parts of the country which was convened by Sidney Wormald of Stockport and held in Manchester, Aug. 31, 1875, when a resolution, proposed by John Dennant of Brighton, was passed, calling for legislation embodying "the adoption of the principles of registration and compulsory education." The success of this meeting was partly due to the energetic propaganda carried on for some time previously by Charles James Fox in the *British Journal of Dental Science*, of which he was the editor. He occupied the chair at the meeting. A definite campaign was started, and John Tomes was to the fore once again. He was supported by many good men, both in London and the provinces, chief of whom was James Smith Turner, who did yeoman work in the cause.

DENTISTS' ACT

A bill was introduced into Parliament, its success being ensured by the vigorous efforts of a layman, Sir John Lubbock (who later became Lord Avebury), and in 1878 the Dentists' Act was passed "to amend the law relating to dental practitioners."

The Dentists' Act of 1878 established the Dentists' Register, and so far effected a change for the better. It also made the assumption of the title "dentist" illegal by any who were neither on the medical nor the dentists' register; but as its penal clauses were easily evaded, it required the Act of 1921 to establish dentistry on a secure basis, only to be attained by adequate education and the compulsory observance of a clean ethical code.

THE BRITISH DENTAL ASSOCIATION

Very soon after the Act of 1878 was passed by the legislature, the Dental Reform Committee was dissolved, and its place taken by the British Dental Association. This association was incorporated, June 3, 1880. To quote its memorandum of association:

> The objects for which the Association is established are the promotion of dental and the allied sciences and the maintenance of the honour and interests of the dental profession by:—
>
> (*a*) The periodical meetings of the Members of the Association of the dental profession generally in different parts of the country.
>
> (*b*) The publication f a periodical Journal, and by
>
> (*c*) The maintenance of the spirit and provisions of the Dentists Act by such lawful means as may be necessary.

The founders of the association, with Sir John Tomes at their head, were chiefly concerned with two things: to bring into membership as many as they could of the reputable practitioners whose names stood on the register; and to make the Act of 1878 as effective as possible. With regard to the enrollment of members, the sweep of the net was made a wide one, no qualifications being demanded from the candidates beyond registration and reputable conduct. The success of this policy was abundantly shown in the suceeding years, by the steady growth of ethical feeling, and by a gradually permeating sense of solidarity which broke down the barriers of exclusiveness, uniting the profession as nothing

else could have done. With the arduous missionary work which all this demanded, many names are associated. Among those who have passed away, none deserve more honorable mention than James Smith Turner and W. B. Paterson, who toiled as honorary secretaries, a heavy task in the days when honorary officials bore all the work on their shoulders. W. H. Waite of Liverpool did invaluable service in the North; George Cunningham of Cambridge will always be remembered for his brilliant advocacy of the cause at home and abroad; Thomas Gaddes worked and fought incessantly for the causes that the association had made its own, as did Isaac Renshaw of Rochdale.

The efforts of the association in promoting the application of the Act of 1878 was a work which called for unfailing vigilance and dogged perseverance, especially when, as years went on, it became evident that legislation, to be really effective, must go far beyond the protection of title and the maintenance of a register on which no one was under any legal compulsion to enroll himself. It soon came about, therefore, that the association more and more concentrated its energies on the principles (1) of prohibiting by statute all unregistered practice, and (2) of properly controlling all registered practitioners in order to establish and maintain a high standard of education and of professional behavior.

There were great difficulties in the way of legislation, the principal of which were the opposition of the unregistered and the apathy of the public. This apathy, arising from ignorance of the true facts of the matter, was, to some extent, shaken by the report of a government interdepartmental committee, especially appointed in 1904, on physical deterioration. Valuable evidence was given before this committee by W. H. Dolamore, then honorary secretary of the British Dental Association. The report showed, among other things, that the condition of the nation's teeth was at the root of much general deterioration and that there was a wide need for properly trained dentists. But it was not until nearly twenty years later that, as a result of another government inquiry, definite action was actually taken.

In 1917, a departmental committee was appointed to consider "The Dentists' Act of 1878," and "The extent and gravity of the evils of dental practice by persons not qualified under the Dentists' Act."

Among those whose evidence before the committee contributed materially to the conclusions at which the report arrived, were Norman Bennett, Montagu Hopson, Bryan Wood, E. Y. Richardson, Sidney Spokes, and T. A. Coysh, and also the late Denison Pedley, all conspicuous members of the British Dental Association.

DENTISTS ACT AMENDED

The committee reported in 1919. Its recommendations led directly to the Act of 1921. The bill which preceded the act was fathered by Christopher Addison and Sir Alfred Mond, successively ministers of health, advised by Sir George Newman, the energetic and enlightened medical officer to the ministry. Considerable opposition to the bill had to be overcome, the legislature refusing to grant the closing of the profession and the consequent monopoly

without a very generous consideration for the unregistered practitioners who claimed vested interests and sufficient capacity to be admitted to the privileges conferred by the measure. The resulting act was, everything considered, a triumph for the principles for which the British Dental Association had been so long contending. There can be no doubt that, while other forces contributed to the consummation achieved, the chief contributing factor lay in the strenuous and persistent spade work done by the association throughout four preceding decades.

PROHIBITION OF UNREGISTERED PRACTICE

The results attained by the Act of 1921 have already proved substantial. Entrance to the dental profession in the United Kingdom has been effectually closed to all whose names do not stand on the medical or the dentists' registers, exception being made in the case of registered practitioners in medicine. Every dentist has been brought under the control of a statutory body, the dental board, which acts in conjunction with, and under the ultimate authority of the general medical council.

GROSS ADVERTISING ABOLISHED

All gross forms of advertising—sky-signs, blatant notices, show-cases, circulars, newspaper puffs—have practically disappeared. Canvassers are abolished, and commissions made an offence. Men and women can now prepare to enter the profession with the certainty that it has ceased to be the happy hunting ground of the illiterate quack, and that all those now entering on it must exhibit a high standard of education.

STATE DENTISTRY

Having, through the legislature, taken steps to purge the profession and to ensure maintenance of efficiency, the state continues in permanent touch with the dental service of the country through the privy council, and through five government departments: the ministry of health, the board of education, the war office, the admiralty, and the royal air force.

THE DENTAL BOARD

It may be noted, as a democratic feature in the constitution of the dental board, that its chairman is a layman, three of its members are laymen, three are medical, and six dental practitioners, the six dental members being elected for a term of five years by the dentists of the United Kingdom.

The dental board, besides being charged with maintaining the purity of the register, and the observance of a high ethical code, is concerned with the financial welfare of dental schools and the assistance of undergraduates; it promotes the research, and it seeks by suitable propaganda to enlighten the public as to the grave nature of dental disease, and the importance of adequate dental service.

The chairman of the board, the Hon. F. D. Acland having presided over the committee whose work led up to the Act of 1921, possesses ample knowledge of what is expected of the board, and, by his energy and understanding, has done a great deal to render it an efficient instrument for good.

Owing to the unremitting representation on the part of the British Dental Association, great reforms have, within recent years, been effected in the dental equipment of the fighting services, and,

at the present time, the Navy, the Army and the Royal Air Force are served by dentists duly recognized by service rank.

SCHOOL DENTISTRY

The question of school dentistry was first seriously considered in England at a meeting of the British Dental Association held at Cambridge in 1885, when William M. Fisher of Dundee read a paper on the "Compulsory Attention to the Teeth of School Children."

This was followed up by initiation by George Cunningham of Cambridge of a scheme for the inspection and charting of school children's teeth. The scheme, worked out by a committee of the British Dental Association, led to the inauguration of a system ultimately resulting in the assumption by the state of the treatment of children in schools under the authority of the board of education and the ministry of health. The provision of this treatment rests with local educational bodies. At first, these bodies were allowed to apply treatment at their own option, but it has now been made obligatory, and all the schools are gradually being brought under this statutory system. There are two things that make universal treatment impossible of application at the present time. One is the overwhelming weight of postwar taxation which is hampering every progressive movement in Great Britain in its struggle to fulfil honorably its postwar obligations. The other hindrance lies in the passive resistance of parents, as yet not sufficiently appreciative of the value of preventive dentistry.

In July, 1898, the School Dentists Society was founded. The first president was Sidney Spokes, who had already done invaluable work in connection with the movement for the care of children's teeth.

The efforts of these pioneers increased public interest and have led to the formation of school dental clinics in every part of the country.

"INDUSTRIAL" DENTISTRY

During the last twenty years, there has been a considerable extension of dentistry among the wage-earning classes. The development has proceeded in several directions. The official introduction of dentistry in the primary schools of the nation has been mentioned already. It helps to form the habit of mind, both in children and in their parents, which, as a matter of course, holds dental treatment to be not only a desirable but also a necessary thing. Public appreciation of the importance of dentistry is still further stimulated by the definite appointment of dentists with recognized rank in the Navy, the Army, and the Royal Air Force. In addition to this, there has been a remarkable increase in the number of industrial firms that find it to their advantage to have attached to their staff dentists whose whole time is occupied by attention to the needs of the firm's employes.

NATIONAL HEALTH INSURANCE DENTAL "BENEFITS"

Again, since the introduction, a few years ago, of dental benefit in connection with national health insurance, a large section of the population hitherto careless of their teeth have come to realize the possibilities offered by dental treatment for the comfort of the teeth themselves and for the cure and prevention of grave systemic disease.

This development on insurance lines could not but effect deeply the interests

of the majority of dentists. To protect those interests, various steps were taken. The British Dental Association formulated a scheme of accommodation with the insurance societies concerned, and, on the lines of this scheme, the necessary measures were put into operation.

PUBLIC DENTAL SERVICE ASSOCIATION

To carry them out fully, a new association sprang into existence, with a wider franchise than the British Dental Association. The latter body, since 1921, has suspended certain articles of its constitution which make eligibility for membership depend on registration and reputable practice alone, those only who possess an academic qualification being, at the present time, held to be eligible for candidature. A society called the Public Dental Service Association has been formed, definitely concerned with insurance work, and admitting to its membership any practitioner of reputable practice, irrespective of his possession or nonpossession of academic qualifications. The two associations, it should be said, are in no sense antagonistic. They are, in fact, closely cooperating at the present time in the difficult task of obtaining from the insurance societies the fair recognition which the profession rightly demands. The two associations just described are assisted in their insurance labors by two other bodies, namely, the Incorporated Dental Society, which came into existence before the introduction of the amending legislation of 1921, to watch over the interests of unqualified practitioners; and the British Society of Dental Surgeons, composed only of those holding academic qualifications.

DENTAL SOCIETIES

The Odontological Society (now an integral part of the Royal Society of Medicine) and the British Dental Association have been dwelt on already at some length, because their story is so intimately bound up with the history of dentistry in Great Britain; but there are other well-known societies which have held, and still hold, honorable places in the dental world, and with which many distinguished men have been associated.

In 1867, the Odonto-Chirurgical Society of Scotland was founded, and Robert Nasmyth was elected its first president. He was the brother of the Alexander Nasmyth who, in 1839, published in London a very important treatise on "Researches on the development, structure and disease of the teeth."

Among other dental societies founded in the latter half of the nineteeenth century were the Sheffield and District Association of Licentiates in Dental Surgery (1883), the Manchester Odontological Society (1885), the North of England Odontological Society (1894), the Liverpool and District Odontological Society (1895), the Odontological Society of Dublin (1896) and the Glasgow Odontological Society.

The British Society for the Study of Orthodontics owes its origin chiefly to the activity and enthusiasm of J. H. Badcock, George Northcroft and Harold Chapman. It was founded in 1907, with Mr. Badcock as its first president. This society has made uninterrupted progress both in its membership and in its influence among other dental societies.

DENTAL SCHOOLS

As soon as the effect of dental reform began to be felt throughout the country, dental dispensaries and hospitals sprang up in most of the large cities and, today, in one form or another, they are to be found in every important center. The origin of the Royal Dental Hospital and School, and of the National Dental Hospital (now associated with University College Hospital) has already been given. Other schools have now to be mentioned.

SCOTLAND

During the early part of the nineteenth century, John Goodsir became apprenticed to Robert Nasmyth, an eminent dentist in Edinburgh, and, while with him, published, in January, 1837, in the *Edinburgh Medical and Surgical Journal*, his important investigation on the "Origin and Development of the Pulps and Sacs of the Human Teeth."

John Smith was active in the interests of the dental profession in Edinburgh for many years, and, in 1856, he delivered a comprehensive course of lectures on the subject of dentistry, at the Surgeons Hall. Smith, working in conjunction with Robert Nasmyth and others, took steps to establish the dental dispensary which was opened in Drummond Street in January, 1860. This dispensary became ultimately the Edinburgh Dental Hospital and School. W. Bowman Macleod, for many years the dean of this institution, will always be remembered for his devoted zeal in promoting its welfare. After the passing of the Dentists' Act in 1878, the Royal College of Surgeons of Edinburgh decided to institute a license in dental surgery. It is of interest to recall that William Hunter, who made a great stir in the medical and dental world by the publication, between 1900 and 1921, of various papers on "Oral Sepsis as a Cause of Disease," is a graduate of Edinburgh University.

The Glasgow Dental Hospital was opened in 1879. The school associated therewith has been incorporated in the University of Glasgow. Dental schools have also been established as departments of the universities of Aberdeen and Dundee.

IRELAND

The Incorporated Dental Hospital of Ireland was founded at a private house in York Street, Dublin, in 1879. The dental school was opened for students in 1884.

The Royal College of Surgeons of Ireland for some years subsequent to the passing of the Act of 1878 granted its licentiateship in dental surgery *sine curriculo* to candidates who succeeded in passing its final examination.

In Belfast, a dental school has been founded more recently.

The Liverpool Dental Hospital was founded in the year 1860 as the Liverpool Dispensary for Diseases of the Teeth, at 82, Russell Street, and owes its origin mainly to exertions of W. J. Newman, a dental surgeon practicing in that city.

In 1910, an entirely new building was erected for the hospital and school in Pembroke Place, and, in 1921, a separate building for the dental school, as distinct from the hospital, was opened, and this became a department of the University of Liverpool. Liverpool is the only university in the British Isles at which a chair in dental surgery has been fully endowed and in which a full-time professor, W. H. Gilmour,

has been appointed to undertake the duties of the professoriate. W. H. Waite, one of the pioneers of dental reform, was actively associated with the Dental Hospital and School of Liverpool during practically the whole of his life.

The Birmingham Dental Dispensary was opened in 1868, and out of this organization arose the Birmingham Dental Hospital, and the school of dentistry which is now attached to the University of Birmingham.

The Dental Department of the Victoria University of Manchester was founded as the Dental Hospital of Manchester in 1884, and it has since become an integral part of the Faculty of Medicine in the Victoria University. The new hospital was opened in 1909.

The University of London has instituted two dental degrees and the Universities of Liverpool, Birmingham and Manchester all offer degrees, as well as licenses to practice dentistry, and the same may be said of Bristol, Durham, Leeds and Sheffield, where dental schools are attached to the respective universities of those cities.

GUY'S HOSPITAL DENTAL SCHOOL

Although the dental school at Guy's Hospital was not established until the year 1889, the association of this hospital with dental surgery dates back much further in its history, for, probably, it can claim to be the first general hospital in Great Britain to appoint a dental surgeon to its staff, and it was the first hospital to institute a special course of lectures in dentistry.

Joseph Fox was appointed dental surgeon to the Hospital in 1799, and, beginning in the spring of that year, he delivered a regular course of lectures in dental surgery. This has been described as the first organized attempt to teach the subject of dentistry. Fox published, in 1803, "The Natural History of the Human Teeth" and, in 1806, a second volume appeared under the title of "The History and Treatment of Diseases of the Teeth, the Gums and the Alveolar Processes, and the Operations which they respectively require."

Thomas Bell was enrolled at Guy's and St. Thomas' Medical Schools in 1813, and, in 1815, he became a member of the Royal College of Surgeons. (This was the year in which John Keats, the poet, entered Guy's as a student.)

Bell is said to have been appointed dental surgeon to Guy's Hospital in 1817. He remained on the hospital staff until 1861, and lectured regularly to the medical students on dental surgery. In 1828, Bell was elected a fellow of the Royal Society, of which society he was one of the secretaries from 1848 to 1853. In 1828, he published his treatise on "The Anatomy of the Teeth and the Diseases of the Teeth."

From 1853 to 1861, Thomas Bell was president of the Linnean Society and he presided at the meeting, July 1, 1858, at which Darwin and Wallace read their epoch-making papers on "The Origin of Species." Thomas Bell was one of the first examiners for the L.D.S. England diploma in 1860. He died in 1880.

Samuel James Salter, Henry Moon and F. Newland-Pedley were appointed dental surgeons on Guy's staff successively in 1851, 1870 and 1885. The last named, F. Newland-Pedley, was responsible for the idea and formulated plans for founding a dental hospital

and school as an integral part of a large general hospital. It required considerable energy and enterprise to carry his proposals through, for there were many opposing forces both within and without the hospital; but, with the friendly assistance of the dean of the medical school, Dr. (now Sir) Cooper Perry, a scheme was prepared and agreed to by the governors. Thus, the dental school, which has become the largest in Great Britain, was founded, and Montagu F. Hopson was enrolled as its first student, Feb. 7, 1889.

The London Hospital appointed its first dental surgeon in 1857, and, in 1911, a dental school was established under the aegis of the London Hospital School of Medicine. This school has rapidly increased in size during recent years.

The latest of the general hospitals to establish a dental department as part of the hospital scheme is King's College Hospital at Denmark Hill, S.E., where the new dental school was opened in 1923.

It is not proposed, in this report, to give a complete list of British writers and investigators on dental subjects, but besides those who have already been mentioned, the names should not go unrecorded of William Robertson who, as early as 1839, indicated carbohydrates as a factor in the etiology of dental caries; of Spence Bate of Plymouth, whose inquiries into the development and structure of the teeth and the causes of caries came a little later; of Sir Charles Tomes, for his work on dental anatomy; of J. Howard Mummery and Douglas Caush, for their labors in histology; of Sir Frank Colyer for his writings on dental surgery and pathology, and of Sim Wallace, whose pronouncements on the causes of dental caries have exercised such a widespread influence. Thomas Fletcher of Warrington, J. H. Gartrell of Penzance and John Girdwood of Edinburgh are outstanding examples of those who, by their ingenious inventions, have done much to establish prosthetic processes on scientific lines.

With reference to literature, the founding of the library of the British Dental Association must be mentioned as an important departure. Mainly through the instrumentality of W. H. Dolamore, this library was inaugurated when the Association, in 1920, came to occupy its present house in Russell Square. It has grown rapidly in value and in extent, and, thanks to the fostering care of Mrs. Lillian Lindsay, its honorary librarian, it has already attained an honored position among other libraries devoted to dental subjects. It is now the most complete dental library in Great Britain.

In conclusion, it may be noted that the law, in Great Britain, permits the practice of dentistry to a medical practitioner whose name is enrolled on the medical register, without demanding from him any special training in dentistry, but, as a matter of fact, it is rare to find any medical man practicing dentistry without a dental qualification.

Dentists, on the other hand, unless possessing a general surgical qualification, do not often undertake any operations beyond those appertaining strictly to dentistry.

It may be observed that the relationship which has grown up between medical and dental practitioners in Great Britain has steadily tended to become

more and more marked by a friendly spirit of mutual understanding and ready cooperation.

DISCUSSION

William H. Trueman,† *Philadelphia, Pa.:* Of the early London dentists named by Mr. Matheson, Alexander Nasmyth deservedly has a place. Although he entered the profession late, he soon overcame that handicap, and, in a few years, qualified himself for membership with the Royal College of Surgeons, London. His contribution to dental literature, five small volumes, as one of his biographers states, seems small and may easily be grasped by the fingers of one hand, but they are of high quality. He was a pioneer in applying the microscope to the study of the structure of human teeth. The microscope, as he found it, was crude compared with those of today. His first task was to correct its defects, optical and mechanical. Valuable as his work is, it would have been far more so had he lived to complete it. The microscope did not become an instrument of precision until its records were made permanent by means of photography. As long as its records depended on an artist's pencil, the personal equation made its records uncertain. Eyes do not see alike, and there is so much important detail no artist can accurately record. Thomas Berdmore was the author of the first work in the English language that attempted to cover the whole field of dental surgery. We need no further testimony of its merit than that it had five editions between 1768 and 1777: the Dublin editions of 1768 and 1769, the London edition of 1770, Amsterdam, 1769, Altenberg, 1777; and a further compliment is shown by the Baltimore reprint of 1844, seventy-six years after its first publication. Through the kindness of a Nottingham dentist, I have been furnished with the following notice of his death as recorded in a Nottingham newspaper:—"On Monday morning, Nov. 7, died at his home in Fleet St., London, of gout in his stomach, Thomas Berdmore, Esq., aged 44. Surgeon Dentist to His Majesty and the Prince of Wales, also member of the Corporation of Surgeons. This gentleman, whose death is universally lamented, was son to the Rev. Dr. Thomas Berdmore, formerly Vicar of St. Mary's Church, Nottingham." I also have a photograph of a memorial tablet to his memory on the wall of the church, which reads as follows:

Near this Place
Lies interr'd the Body of
THOMAS BERDMORE, Esq.
Who acquired a liberal
And ample Fortune,
By the Profession
Of Dentist.
He died the 7th of Nov. 1785.
Aged 45 Years.

Shortly before this photograph reached me, William Bebb, of Chicago, sent me a copy of Berdmore's will, taken from a newspaper scrap pasted inside the cover of a copy of his work, in which he selected his burial place, and ordered the erection of this tablet with the inscription engraved thereon.

†Deceased.

THE FORMATION OF THE POCKET: DIFFUSE ATROPHY OF ALVEOLAR BONE*

By BERNHARD GOTTLIEB, Vienna, Austria

WHEN dealing with pathologic processes in any given province, we must first clearly understand the normal process. We must try to understand biology as a whole and not confine ourselves to any small part. If, from a biologic point of view we study comprehensively the rise and decay of living things, we soon see that the limits which have been drawn between the different spheres of natural science have been artificially created and are little founded on the nature of the processes themselves. Especially are the transitions from young to old and from normal to pathologic gradual, so much so that any separation is a hindrance to the understanding. Accordingly, the scientist will do well to regard things in their entirety, that is, biologically, and and not as we have so commonly done, from the physiologic or pathologic standpoint only.

Thus, although it is our task to speak here of the loss of teeth, we must start with their development. At the time of its formation, the enamel is closely joined to the ameloblasts. The latter continue into the surrounding tissues up to the outer enamel epithelium. When, after formation of the enamel, the ameloblasts are resorbed and the stratum intermedium and the enamel pulp have atrophied, the outer enamel epithelium is as closely connected organically with the enamel surface as the ameloblasts were before. There is no real gap between these two tissues. The eruption of the tooth takes place in such a way that the top of the outer enamel epithelium unites with the epithelium at the mouth. A hole is formed at the point of union, and that part of the enamel which has been disclosed now projects into the mouth. The entire rest of the outer enamel epithelium is still joined to the enamel surface as before.

The further eruption of the tooth takes place in such a way that it moves toward the occlusal line, and the outer enamel epithelium detaches itself, *pari passu*, from the enamel surface. When the tooth has reached its antagonist, we speak clinically of the completed eruption. We formerly believed that the development of the teeth was completed then, and that a pause followed. This is no more true of the teeth than of any other organ of the living being. We often make the mistake of taking retardation in the rate of development

*Read before the Section on Periodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

for a complete standstill. Then, at a later stage, if the speed of the process is accelerated, we seek in vain for the origin of this apparently new process, which is really nothing else than an accelerated phase of a single biologic phenomenon. We should not, therefore, break the continuity and consider the development of the teeth finished at the moment they have reached the occlusal line. In fact, when we have corrected a histologic detail formerly considered correct, we will find ourselves forced to keep an eye on these processes. I refer here to the following phenomenon: When the teeth have reached the occlusal line, the detachment of the outer enamel epithelium has not yet advanced so far as was formerly believed, namely to the amelocemental junction. In the thirteenth year of age the bottom of the pocket is generally near the dividing line between the middle and the cervical third of the anatomic crown. The last third is still attached to the outer enamel epithelium, and it is very probable that, at this stage, the calcification of these parts may still proceed. After this, the eruption of the tooth advances, but at a slower rate. The tooth grows farther out of the alveolus, while the epithelium continues to detach itself from the surface of the tooth. Whereas, up to the end of what we may call the clinical eruption of the teeth in different individuals, the variation in the speed of eruption is small, it becomes relatively greater from then on. We know that, in rickety children, the rate of eruption is very much slackened. The abnormal eruption, as compared to normal eruption, may show a difference of several years. In later life, these differences may increase to decades. In one case, the bottom of the pocket passes below the amelocemental junction at some points, long before the twentieth year. In another, the bottom of the pocket is still on the enamel at the fortieth year. Let me here refer only to the fact that, from this point of view, the slackened eruption in rickets, which we have called pathologic, may take on a different aspect.

When, in the course of eruption, the bottom of the pocket approaches the amelocemental line, a downward growth of the epithelium always sets in. This phenomenon always precedes the period of coincidence of the bottom of the pocket with the amelocemental line. Thus, the epithelium is always joined to the tooth along part of its surface. This we call the epithelium attachment. The bottom of the pocket never stays longer at the amelocemental junction than at any other point of the tooth surface. The bottom of the pocket never passes the amelocemental line simultaneously on each tooth in the arch. It does not even pass this line uniformly along the circumference of any given tooth. In other words, eruption is quite independent of the amelocemental line. We have no right to speak of the eruption of the anatomic crown as an event complete in itself. Biologically speaking, we know only of an eruption of the tooth as a whole, independent of any separation into crown and root.

Before proceeding further, let me mention the conditions under which formation of the cuticle occurs. After completion of the enamel, the ameloblasts can form a cuticle one micron thick, which can calcify. But this is not in reality that structure which is gener-

ally valued as being especially resistant to alkalis and acids. Chemically, it is not at all different from the true enamel. On the other hand, the outer enamel layer is capable of forming a cuticle which attains a thickness of about 4 microns on the average, before becoming detached from the surface of the enamel. This is resistant to alkalis and acids. The entrance to the enamel lamellae may also be stopped up by this substance. In the course of the downward growth of the epithelium along the cement, an identical stratum is formed on the surface of the root. This cuticle thus fully deserves the name cuticula dentis, covering, as it does, both crown and root. Let us here only touch on the fact that the covering of the tooth surface and the bridging of the fissures of the enamel with a substance resistant to alkalis and acids is of importance in the etiology of dental caries.

There is a corresponding relativity of position of the bottom of the pocket to the position of the alveolar crest. In the reciprocal relation between these two, we must not imagine that a definite distance is fixed as normal, and that variations from it are pathologic. The physiologic possibilities vary within wide limits, as also the length of the epithelium attachment. The atrophy of the alveolar crest, concurrently with the displacement of the bottom of the pocket, must be regarded as an integral part of the physiologically continual eruption of the tooth.

For better understanding, we will call the part of the tooth from the bottom of the pocket to the top of the crown the clinical crown. When the tooth has erupted to the occlusal line, the clinical crown is about two thirds the length of the anatomic crown. In the course of further eruption, the height of the clinical crown remains, in ideal cases, constant. This is due to the fact that the tooth is worn down on its incisal or occlusal surface to a degree which compensates for the eruption. The length of the clinical crown is the extra-alveolar lever of the chewing apparatus. Conditions being the same, the longer the extra-alveolar lever, the greater the force exerted on the holding apparatus by the act of chewing. The constant grinding down of the masticatory surfaces in the course of eruption is likewise necessitated by the fact that the equal unobstructed growth of all the teeth would in time prevent the closure or articulation of the front teeth, the back teeth being nearer to the pivot of the lower jaw than are the front teeth. There are also two other possibilities by which this same result might be obtained. First, the anterior teeth might grow faster than the posterior ones, which is unthinkable; or, second, the posterior teeth might be forced down into the jaw sufficiently to bring them into the proper relationship to the anterior ones. The latter can indeed happen, but, in such cases, a great stress is exerted on their suspensory apparatus. This stress can be withstood only where the denture is very strong; otherwise an eventual loosening of the teeth is unavoidable. Throughout the animal kingdom, we find the wearing of the tooth surfaces to be the normal regulator of the articulation, so that it is probably to be considered the ideal method of adjustment.

The protrusion of the teeth toward the occlusal line is not the only movement which they undergo in the course of physiologic eruption: they shift also in a mesial direction; which results in the continual closing of the tooth arch,

even though, in the course of time, much tooth substance may be worn away at the contact points by mutual abrasion.

We shall now discuss the conditions in the region of the pocket. First of all, it is only recently that we have had a proper conception of the physiologic depth of the pocket. Here, again, we had been led astray by making too sharp a distinction between the physiologic and the pathologic. The false estimates are chiefly to be attributed to the assumption that, after the establishment of the tooth on the occlusal line, the bottom of the pocket was at the amelocemental line. On this assumption is based the estimate of 1.5 or 2 mm. as the physiologic depth of the pocket. All these postulates are false.

Frequently we find pockets of practically no depth at all. From this minimum, we find all grades of transition up to the greatest depth, without being in any way, or at any one point, justified in drawing a line between physiologic and pathologic conditions. As we have seen, the same remark holds good in regard to the length of the epithelium attachment, and also in regard to the distance of the alveolar crest from the bottom of the pocket or from the lowest point of the epithelium attachment. It would doubtless be possible, by means of a great number of measurements, to arrive mathematically at some figure indicating the average or most frequent depth. I cannot think that it is worth while mentioning such possibilities, unless it be with the thought of warning one not to overestimate them.

Concerning the pocket, we must mention the following facts. In ideal cases, the pocket epithelium is hornified down to the bottom. The opposite tooth surface is covered with horny cuticle. The depth of the pocket is very small. Thus, we find at the weakest point of our denture an ideal protection against injury. To sum up what I have been saying concerning the physiology of the denture: We have specified the following processes as comprising the normal evolution of the teeth: 1. The migration of the epithelium attachment toward the apex. 2. The simultaneous atrophy of the alveolar crest. 3. The protrusion of the teeth toward the occlusal line. 4. The mesial displacement of the teeth. 5. The compensating abrasion of the teeth both at the occlusal surface and at the points of contact. These processes are continuous although at varying pace.

Every attempt to depict these processes with mathematical certainty either as to speed or distance is certain to prove abortive. We can only assert in which direction the optimum lies. In the opposite direction, physiologic conditions pass over imperceptibly into pathologic.

We come now to consider more closely this transition of physiologic to pathologic. In the first place, we must focus our attention on the rate of eruption. This should, in ideal cases, be such that the length of the unerupted part is sufficiently great to provide an undisturbed capacity for mastication until death ensues through functional failure of some organ essential to life. In creatures with teeth of similar length, we can assume a greater rate of eruption in those enjoying a short term of life than in those whose lives are comparatively long. Where the term of life is equal, a greater speed of eruption is permitted to longer teeth. We know that humans have teeth of vary-

ing length, and we are enabled to see, in this fact, a source of pathologic occurrences. Human beings are, in general, designed for the same term of life, and thus if the teeth are long we may consider that a more rapid eruption falls within normal bounds; whereas, when the teeth are short, the same rapid rate of eruption would be abnormal. A distinct, although slight, compensation is sometimes to be seen here. Rickets is generally betrayed by the shortness of the teeth, but, in such cases, we commonly find a slackened rate of eruption. On the other hand, we often find accelerated eruption where the teeth are long.

The extension of the epithelium attachment is an important associated phenomenon in eruption. It is not necessary for the epithelium attachment to have reached the apex for the functional capacity of the tooth to be at an end. It suffices if the surface of the clinical root is so much reduced that it can no longer answer the mechanical demands. Consequently, at each bite, the tooth must give way, and the suspensory apparatus is so damaged, even under normal use, that the tooth is doomed. We must regard the rate of eruption as the dominant factor in all pathologic conditions. After a certain stage of eruption is reached, the normal function becomes traumatic and results in injury. This is also the case when all the above mentioned components of eruption are progressing in due order. In such cases, of course, the pathologic conditions are not arrived at until a much later stage.

Another source of pathologic conditions is the disturbance of the synchronism of the various elements of eruption. When, for example, the abrasion of the chewing surface does not keep pace with the downward growth of the epithelium, the extra-alveolar lever gets longer and longer, and the same force exerted on the tooth puts greater stress on the suspensory apparatus. Further, when all teeth do not erupt at a uniform rate, but one advances faster than its neighbors, this tooth is, as a rule, not worn down correspondingly, and the whole biting strain falls to it. Such a tooth has already been weakened by other causes, and, as a result of this overstrain, it soon comes to an untimely end, unless it be ground down at an opportune time by operative procedure. This happens not only to individual teeth but to groups of teeth. The departure from normal movement of the teeth may be designated as pathologic wandering. Theoretically, it can take place in any direction except downward into the jaw. But, as a matter of fact, by far the most important pathologic wandering is toward the occlusal line. Lateral wandering is not uncommonly to be observed, and to this belongs the formation of a diastema. Also, in the course of lateral wandering, the tooth may be subjected to secondary strains to such an extent that it may soon fall out. This pathologic wandering must not be confused with the shifting of the teeth in youthful subjects, which generally follows an extraction. In the latter case, the tooth moves with its alveolar bone; while, in the pathologic wandering, it moves out of the alveolus.

Just as accelerated eruption results in lengthening clinical crowns, so also eruption is retarded in particular teeth relatively to the whole denture, giving the appearance of a "short tooth." As a rule, it will be found that such short teeth are the firmest.

A further and particularly common disharmony is the result of the following phenomenon: the downward growth of the epithelium attachment is not equivalent on all teeth, nor even on all sides of the same tooth. If the parts which undergo accelerated eruption are favorably situated, no secondary injury is likely to follow this primary injury. Often, we see lingual roots of upper molars or labial surfaces of cuspids or of lower incisors far advanced in eruption without appreciable secondary injury. There is only one disadvantage, and that is, that the tooth is robbed of its attachment at this place. It is quite otherwise in cases in which the parts undergoing accelerated eruption are situated, for example, proximally, and the neighboring tooth is still in place. Here, the gingival margin cannot recede to an extent corresponding to the position of the bottom of the pocket for morphologic reasons, and there is a consequent deepening of the pocket. A deeper pocket means an increased possibility of retention of material favoring the development of microorganisms. Accordingly, it will not surprise us to find, with such a deepened pocket, a chronic suppurative inflammation.

Chronic gingivitis may also be the cause of the gingival margin not following at an even rate the bottom of the pocket. Every inflammation involves a hypertrophy of the tissue attacked, while the following of the gingival margin involves atrophy. Hypertrophy and atrophy cannot proceed simultaneously in the same tissue. In contrast to the former example, it sometimes happens that, even in normal apical migration of the epithelium attachment, a deepening of the pocket takes place, as the gingival margin does not follow at all. At the bottom of the deepened pocket, an increased inflammation takes place and, without therapeutic intervention, such a process can end only in the tooth falling out, as only then the pocket ceases to exist.

This is a suitable moment to throw further light on these processes. It is eminently important for us to know in what relation the activity of the micro-organisms and the resulting inflammation stand to the disease which we are discussing. Inflammation and bacterial activity prevail in the periodontal tissue extending far into the bone. It is well known that, when we extract a pyorrheic tooth, the suppuration is quenched at a blow. The inflammation was not in the tooth itself, and, by extraction, we have certainly not influenced the inflamed tissue or the micro-organisms; and yet the inflammation instantly disappears. By extraction, there is only one thing which is certainly brought about, and that is the destruction of the pocket. The pocket consists of two walls, the gingiva and the surface of the tooth. By removal of the tooth, the pocket has ceased to exist. From these considerations, we may conclude that the presence of a pocket is the chief prerequisite for the existence of pyorrhea, the inflammation and the bacterial activity being of secondary importance.

So far, we have been laying down morphologic and clinical facts about which doubt is hardly possible. We come now to attempt the analysis of the causal background. We are in possession of a series of isolated facts by the help of which several tentative explanations may be put forward. In the first place, there arises the question as to the causes of the downward growth of the

epithelium and of the detachment of this epithelium from the tooth surface. As long as connective tissue fibers are anchored in the surface of the cementum below the epithelium attachment, obviously a downward growth of the latter is out of the question. We can readily imagine that, after the detachment of these fibers from the cementum, the epithelium (as in many other analogous processes) proliferates downward to cover the exposed connective tissue. This detachment of the connective tissue fibers from the surface of the tooth below the epithelium attachment can be brought about by trauma or inflammation. In regard to the first, it is most remarkable that the downward growth of the epithelium proceeds farther, on the side opposite to what one would have supposed. When a tooth is subjected to lateral pressure, one would naturally have expected that the fibers would be torn on the side from which the pressure comes, allowing downward growth of this side. In reality, the apical migration of the epithelium attachment is generally to be observed on the other side, where the fibers are relaxed. Similar difficulties present themselves in explaining the part played by inflammation. When inflammation has destroyed the fibers below the epithelium attachment, it means that an abscess has been formed there. The epithelium can pass an abscess only when the inflammation has abated. Thus, we must assume that, in cases of downward growth of the epithelium in connection with an inflammation, the latter alternately supervenes and passes off, first destroying the connective tissue fibers and then disappearing to allow passage to the epithelial proliferation. Why, after the disappearance of the inflammation, the connective tissue does not reorganize itself and reattach itself to the tooth surface is a question that can probably never be satisfactorily answered.

Apart from all this, there arises the question as to the manner in which the epithelium is induced to attach itself to the surface of the tooth, to detach itself again sooner or later, with or without formation of a horny cuticle. This question is particularly relevant to the detachment from the enamel surface, for here the processes in the connective tissue cannot come into consideration as causal factors. Whereas, I have held different qualities of the tooth surface responsible, other authorities attribute these processes to the effect of marginal inflammation. In such questions as these, it is of the greatest importance to endeavor, aside from theoretical conditions, to discover some morphologic basis from which our explanation may proceed. It is my privilege to show some examples which seem clearly to demonstrate that growing cementum hyperplasias below the epithelium attachment constitute a hindrance to its downward growth. The continuous, if slow, deposition of new cementum layers such as we find on all root surfaces may be regarded as the most appropriate measure to check epithelial proliferation. Later, we shall come to speak of the importance of this matter in other directions.

Of great importance is the relation of the marginal inflammation to these processes, and the manner in which we interpret its effects is of great consequence. We are not speaking here of that inflammation of an acute nature which leads directly to suppurative destruction of the tissues. Neither do the

chronic inflammations of this kind, with the formation of abscesses, enter into the question. Indeed, the apical migration of the epithelium attachment proceeds, as a rule, without any such complications. The inflammations which we are considering here are those slight infiltrations which are in most cases below the bottom of the pocket.

The connection of the connective tissue fibers with the surface of the cement is an organic one. That is to say, not only the fibers, but also the surface of the cementum, must have some kind of life, in order that this connection can exist and function. All that lives can also die. This organic connection can persist neither when the fibers of connective tissue die, nor when the cementum surface dies. And inflammation of varying degree may obviously result in the death of living elements without its necessarily leading to a suppuration with abscess formation. I thus picture the effect of inflammation on the proliferation of the epithelium: where the sources of the inflammation have killed either the connective tissue fibers or the cementum surface or both, the connection will be dissolved and the epithelium will proliferate downward in accordance with an inevitable law until it comes up against an organic connection between the connective tissue fibers and the cementum surface. That it is not necessary, for the dissolution of this connection, to have complete death of the cementum surface is shown by the fact that the downward growing epithelium makes organic connection with the surface of the cementum, whoch would be impossible were the latter quite dead.

The effects of inflammation also come into consideration in cases of periapical granulomas, in which we find exactly the same conditions prevailing as regards the epithelium attachment as in the region of the pocket.

Very similar are the conditions as regards the processes in the alveolar bone. We know from our study of general pathology how sensitively bone reacts to inflammation in adjoining tissue. In our study of periapical processes we find the same reaction to even slight stimulus or irritation. We find, on the other hand, chronic marginal inflammations extending into the marrow spaces and gradually destroying the bone. Neither in the downward growth of the epithelium nor in the atrophy of the bone can we find a strict parallelism between the degree of inflammation and the processes involved. We can even see that, in some cases, an inflammation effects a cementum-hyperplasia, whose beneficial effects as an agency conteracting the apical proliferation of the epithelium, we have already learned to recognize. We know further, from clinical observation, as well as from histologic research, that, often enough, resorptions occur, on the tooth surface and on the alveolar bone which have nothing to do with inflammation. And finally, it must be remembered that the disappearance of the alveolar crest comprises an integral part of the continuous eruption of the tooth. We wish here to leave the question open as to how this atrophy is brought about. It is much more important to analyze in what manner the normal condition of the alveolar bone is maintained. We know that every bone has functional demands made on it. We know that atrophy of the bone is occasioned by the fact that normal resorption takes place,

while deposition of new bone does not follow on account of the absence of functional stimulation. This brings us to the important law of molting. Speaking generally, no cells, no tissue, with certain exceptions, lives as long as the individual. Cells, as also the intercellular tissues, have only a limited life. They die, are resorbed, and as a rule are replaced where needed; also the bundles of the suspensory apparatus of the teeth do not live so long as the individual. They perish and are constantly renewed. Now these bundles have to be anchored in the cementum. To this end a new layer of cementum must be formed in which these new bundles can be inserted. But the cementum surface also is subject to the law of molting. It therefore happens that a connective tissue fiber loses its hold because of the fact that the part of the cementum in which it is inserted is ready to molt before any new cementum has been deposited on it. If this occurs, then a functionally sound bundle loses its anchorage. From these considerations, we conclude that the maintainance of a tooth in functional activity requires a continual deposition of new cementum on the surface of the root.

Let us assume that, for some reason, resorption of the tooth surface has come about, which unquestionably may happen. The suspensory apparatus then loses its hold at this point, and the opposite alveolar bone loses its stimulus. However, all is not yet lost. Replacement of cementum as well as of bone may take place, a perfect suspensory apparatus being regenerated. A question of particular importance for us is: Where does the repair set in? This question we can safely answer thus, that it must begin with the deposition of cementum. Only by the embedding of new fibers on the surface of the cementum can the functional conditions of the environment be brought again into activity, leading to the reconstruction of the corresponding portion of the alveolar bone. Repair of the alveolar bone without functional demands being made on it is hardly to be expected. I should mention here that under certain circumstances generation of bone takes place in the region of the alveolar process without any demands being made on it by the tooth in question. It must suffice for me to emphasize that, in such cases, it is the neighboring tissues that make the functional demands.

Thus, we see that the condition of the suspensory apparatus, too, depends for the most part on whether there is a continual deposition of cementum on the surface of the tooth.

We come now to analyze the functional demands made on the denture; for this is of the greatest importance in passing a verdict biologically on our prophylactic measures. On the one hand, we hear that our denture is falling into ruin for want of sufficient use. On the other hand, the fact cannot be overlooked that teeth fall out as a result of traumatic occlusion. This would seem to be unquestionably a contradiction, although there is a measure of truth in each of these postulates. When heavy demands are made on the denture, this may equally well lead to a strengthening or to a weakening, but not in the way in which it has sometimes been believed that these phenomena take place.

What does overstrain of a tooth mean? What is the limit of normal functional demands? A tooth is over-

strained when the tensile strength of the suspensory apparatus is exceeded. When this occurs, the tooth no longer hangs by the ligaments, but pushes against the alveolar bone in the direction in which it is forced by the masticatory stresses. Resorption ensues, either of bone alone or of bone and tooth surface together. This leads to the enlargement of the pericemental space, the atrophy of the suspensory apparatus in this region and the loosening of the tooth. We have stated, on the other hand, that, in such cases, repair can only follow a deposition of cementum on the tooth surface. If this occurs, the damage is entirely repaired. If such injuries follow one another repeatedly over a considerable period of time, each followed by complete repair, widespread hyperplasia of the cementum results, effecting an enlargement of the root surface, and thus an enlargement of the holding surface of the tooth. If the reparatory deposition of cementum fails to take place, the enlarged pericemental space persists and the functional capacity of the tooth is reduced. Every further demand made on it involves fresh injury, and the tooth eventually falls out. Thus, we see that, as regards the question of traumatic occlusion, the final issue depends also on the deposition of cementum. In fact, the fate of a tooth is bound to this on every side. That is why, in the herbivora, whose life depends entirely on the good service of the masticatory apparatus, we find the cementum not only forming a thick deposit on the surface of the root but also spreading a layer over the enamel. We generally find, on teeth which have fallen out early, a remarkably delicate cementum layer, and we find, finally, in the ideal denture of the abrasive type, markedly developed hyperplasia of the cementum.

The continual deposit of new layers of cementum on the root surface must be regarded as in every respect the ideal, as not only does it retard the downward growth of the epithelium but it also opposes the enlargement of the pericemental space and the weakening of the suspensory apparatus. Conversely, the absence of deposition of cementum is of fatal significance to the denture. This is most clearly shown in those extreme cases in which not only is the deposition lacking, but also resorption of the root surface has taken place. Such resorptions proclaim themselves clinically in the fact that a wandering from the resorbed place ensues, as if an expulsion of the tooth from its socket would take place in this direction. We can regard this pathologic wandering as pathognomonic of the diffuse atrophy of the alveolar bone, as, to a certain extent, the pathologic counterpart of the physiologic wandering.

As long as the surface of a resorption is not covered by epithelium, it can be completely repaired by deposition of new cementum, in which process the corresponding part of the alveolar bone may also be regenerated. Thus, it may happen that the bone is built beyond its normal plane opposite the resorbed area; for it is by no means necessary that the reparative process shall have restored the original surface of the root, in order that excitation of the alveolar bone to regeneration shall occur.

These features give definite guidance for our conduct in practice. For the present, we cannot claim that we are able to exert any certain influence on the rate of the apical migration of the epithelium attachment. The migration

does not in itself, however, constitute an immediate cause of disease, and we must, therefore see to it that the gingival margin is kept at a point as close to the bottom of the pocket as possible. By persistent maintenance of the conditions necessary to health, we can eliminate one factor in the formation of a pocket, namely, inflammation. We refer here to maintenance of the clinical crowns at an even height. In the field of prophylaxis, we can undertake nothing against the unequal migration of the epithelium attachment along the circumference of individual teeth and the resulting formation of pockets. When such a pocket has developed, we must bestow on it our unceasing care. If, in spite of all care, a chronic suppuration sets in or acute recurring inflammation in the form of periodontal abscesses, we must eliminate the pocket down to its base by means of excision. We should also use silver nitrate or an 8 per cent solution of zinc chlorid, in order that the pocket may not again form. Treatment must be followed by conscientious brushing after the methods of Stillman and Charters.

As regards clinical diagnosis, the following procedure is satisfactory. Diagnosis should be made only in a mouth that has been placed in a hygienic condition. If suppuration proceeds from a pocket in spite of the surface of the tooth being made smooth down to the base of the pocket, a periodontal pyorrhea must be assumed. We may in the first place, attempt to cope with it by vigorous curettage of the inner wall of the pocket. If this does not suffice, we must excise the pocket. A reattachment, such as is described by Box and McCall, is undoubtedly theoretically possible, and these authors have also verified by histologic examination the possibility of reattachment. The extent to which the tooth surface is to be scraped to give the greatest probability of reattachment cannot be determined.

The connective tissue must heal just as much as the epithelium. The connective tissue heals according to the law of plantation, with or without resorption, with or without hard tissue deposition. The epithelium heals by adhesion. Whether the hard substance is composed of dentin or cementum is of no importance for the healing either of the epithelium or of the connective tissue. Whether the epithelium of the inner wall is entirely removed is of vital importance for the healing of the wall of the pocket. If this is not the case, the best that can be effected is an epithelial reattachment, which is naturally far from having the worth of a connective tissue reattachment. In general, we must not count on reattachment as long as we know no more than we do at present on the subject of the law of plantation of the hard substance, and as long as no systematic influence can be exerted on the reattachment. Even with our present means, the attempt must always be made, as no harm can arise from it.

The suggestion of McCall that the epithelium of the pocket be removed by chemical means is to be regarded as most important. Nevertheless, it is more important to find some means for influencing both tooth surface and connective tissue to the end that they may unite and a deposition of cementum follow.

In regard to alveolar atrophy, we may make a distinction between marginal atrophy and diffuse atrophy. Marginal atrophy is present if the

loosening is found to be due exclusively to atrophy of the alveolar margin with the base of the pocket occupying a corresponding advanced position. This is generally effected by chronic marginal inflammation. Diffuse atrophy is evidenced by the presence of wandering and by marked variation in the location of the base of the pocket. Here the loosening is frequently found to be due to an enlargement of the pericemental space.

In a general way, we may say that marginal atrophy is due, in most cases, to neglect. Inflammation and suppuration are early symptoms, while loosening follows later. On the other hand, diffuse atrophy is generally accompanied by periodontal pyorrhea. Here, wandering and loosening are early symptoms, while pocket formation and suppuration come relatively later. The pocket formation takes place, as a rule, on that side from which the tooth is wandering.

We need not consider the question of the distance of the alveolar margin from the bottom of the pocket; for we are not in a position to exert any influence whatever on these conditions. If we have taken the prophylactic measures suitable to the treatment of pyorrhea, we have already excluded the possibility of an inflammation causing alveolar atrophy. As regards functional factors, we can take prophylactic measures, as we can insure the clinical crowns remaining a constant length and in ideal articulation.

In cases in which the teeth are not worn down proportionately to the rate of eruption, we must come to the rescue with carborundum stone, adjusting the occlusion with the same or even greater care than we give to artificial dentures.

In those cases in which the firmness of the denture is so much reduced that normal mastication inflicts injury, or in the teeth which are here and there so loosened that their retention is out of the question, fixation is indicated. In diffuse atrophy with symptoms of wandering, treatment with arsenic may be recommended.

After this survey of the theme under discussion, we may well ask ourselves what direction our researches should take in order that, both prophylactically and therapeutically, we may render the greatest possible services to humanity.

Above all things, we must learn to regard teeth with long roots as the ideal as far as this condition depends on the size of the whole body, and we must consider the evolution of a type of man of large build as desirable. Further, in combating rickets, we are fighting against the formation of short teeth. And it will be our task to discover whether it is not possible to take specific measures to influence the length of the teeth during the course of their development. Furthermore, we must use all the means at our disposal to discover whether we cannot influence the rate of eruption of the teeth. The longest teeth are worthless when the rate of their eruption is too great.

Turning to the other factor: According to the researches which have so far been made, it seems most probable that the continual deposition of cementum on the root is of the greatest importance. We must therefore seek to discover whether this is controlled from any center of the organism which our prophylactic measures might reach and influence favorably; or, again, whether it is not possible to approach the same end by therapeutic means. I regret that it is not within my power

to answer these questions. For the moment we must be content to know what we don't know.

DISCUSSION

Charles E. Sutton, Toronto, Canada: Dr. Gottlieb has presented to us a new concept of the physiology of eruption of the teeth, and has pointed out its bearing on periodontal pathology. It is of the greatest interest to study these views, and to note how they affect and, in many details, completely harmonize with the periodontal concept held by many periodontists of this continent. In the Department of Periodontology of the University of Toronto, our teaching regarding traumatic occlusion and its relationship to periodontal disease is based on the work of Box. He has classified traumatic occlusion into three main types: 1. Primary traumatic occlusion, in which the magnitude of the occlusal force or the manner in which it is delivered is such that overstress is produced in the pericementum of a mechanically adequate periodontium. In this group, as an outstanding example, we find cusp interference in unbalanced occlusion and unbalanced articulation. Cusp interference, as we know, is frequently seen in malocclusion, inharmonious dental restorations and certain types of completed orthodontic cases. Uneven wear, excessive wear and drifting provide other good examples of this group. 2. Secondary traumatic occlusion, in which the magnitude of the original force may be normal, but, owing to inadequate periodontal support, the extra-alveolar lever arm is increased and overstress is produced in the pericementum. Fine examples may be seen in simple border atrophy of the alveolar process and in simplex periodontitis, caused by superficial irritants. 3. Combined traumatic occlusion, presenting abnormality in both occlusal and periodontal factors, a condition that makes for great damage, with rapid and extensive breaking down. Examples of this class may be seen in axial extrusion and lateral wandering, distinctly pathologic phenomena in themselves. In Dr. Gottlieb's concept, the following processes are present in the normal eruption of the teeth: atrophy of the alveolar crest, protrusion of the teeth toward the occlusal line and a compensating abrasion of the teeth at the grinding surface. The height of the clinical crown, in other words, that part of the tooth from the bottom of the pocket to the top of the crown, remains in ideal cases constant, as the abrasion compensates for the eruption. Dr. Gottlieb states that we must focus our attention on the rate of eruption as it must be regarded as the dominant factor of all pathologic conditions. Dr. Gottlieb makes the following statement: "After a certain stage of eruption is reached, the normal function becomes traumatic and results in injury. This is also the case when all the above mentioned components are in marching order." That is to say, traumatic occlusion becomes at once the dominating factor in the natural termination of the life history of every tooth. Dr. Gottlieb states further: "When for example the abrasion of the chewing surface does not keep pace with the downward growth of epithelium, the extra alveolar lever arm gets longer and longer and the same force exerted on the tooth puts greater stress on the suspensory apparatus." Here, we have the physiologic process of eruption furnishing us with types of Box's secondary group of traumatic occlusions. It is obvious that the process of eruption according to Dr. Gottlieb's views can provide examples that fall in Box's primary group, as in accelerated eruption of individual teeth where the magnitude of the original force is such as to become the dominant factor. Dr. Gottlieb also states: "Further, when all teeth do not come out synchronically but one protrudes faster than its neighbors, this tooth is, as a rule, not worn down correspondingly and the whole biting strain falls to its share." Such a tooth has already been weakened by other causes and as a result of this overstrain, it soon comes to a bad end unless surgical help comes opportunely to grind it down. This happens not only to individual teeth but to groups of teeth. This departure from the normal movement of the teeth may be designated "pathologic wanderings." This phenomenon is a fine example of Box's third class of traumatic occlusion, the combined group, previously mentioned. However, in this case, the movement of the tooth is a distinctly pathologic process. Abrasion of the occlusal surfaces has been mentioned as the compensating factor for eruption, and Dr. Gottlieb has stated that, in the animal kingdom, we find the grinding of the tooth surfaces the normal regulator of the articulation and that it is probably the ideal method of

adjustment. Unfortunately, this adjustment through abrasion is so often not ideal and constitutes one of the great factors in the production of traumatic occlusion. Uneven and excessive wear are so often productive of undue torques and the transmission of overstress to the pericementum, with its resultant state of overstrain and tissue alterations. Even tiny facets in enamel may be factors in the production of great damage. Before proceeding further, I would like to call attention to the striking similarity of the classifications of periodontal disease given us by Dr. Gottlieb and Dr. Box. While differing in nomenclature, they are essentially the same from the pathologic and the clinical point of view. This is of the greatest importance and especially momentous to teachers in dental colleges. First, there is Dr. Gottlieb's marginal atrophy, which corresponds with Dr. Box's periodontitis simplex. Here superficial irritants are the causative factors. The pocket as a rule is shallow, and there is little divergence from normal mobility in the early stages. Then comes Dr. Gottlieb's diffuse alveolar atrophy, which seems a counterpart of Dr. Box's rarefying pericementitis fibrosa, a lesion of the deeper structures and characterized by early wandering and loosening. When accompanied by paradental pyorrhea as in Dr. Gottlieb's classification, we see at once Dr. Box's periodontitis complex, pocket formation being characteristically deep and narrow and in many instances of rapid development. Further, I should like to call attention to Dr. Gottlieb's view regarding the relationship of the pocket to the lesions under discussion, that the presence of the pocket is the chief prerequisite for the existence of pyorrhea, inflammation and bacterial activity being of secondary importance. With this view, I stand in complete accord. In many cases, I believe the formation of the pocket has taken place before suppuration sets in, the process of infection being but a secondary factor in the evolution of the so-called pus-pocket. Dr. Gottlieb has stated that a tooth is overstrained when the tensile strength of the suspensory apparatus is exceeded. This is in conformity with the views on traumatic occlusion held by the leading investigators and periodontists on this continent. By the term traumatic occlusion, there is understood the application of force to the tooth which, when transmitted to the pericementum, brings about, in all or part of it, a state of overstrain. The functional equilibrium of the pericemental tissues, in other words, the balance of its various cellular activities, which is maintained by an increase and reduction of its various functional units, is disturbed. The result is seen in the tissue alterations which take place: the formation of perivascular nodules of new tissue, atrophy of the pericemental fibers, and alveolar and cemental resorption with consequent widening of the pericemental space. Investigators have for years been seeking one tissue in the periodontal group to which may be attached the rôle of greatest importance from the standpoint of pathology. This is but a logical aim in this type of investigation. One group has selected the gingivae as the all-important tissue in pathologic change of the periodontium as a whole, while another has centered its attention on the alveolar bone. The researches of Box have revealed the importance of the pericementum and has brought this tissue out of obscurity into a position of the greatest prominence. And Dr. Lang has so well shown that this tissue is dominant tissue in the periodontal group from the standpoint not only of pathology but of repair as well. From Dr. Gottlieb's contribution, we have heard the following conclusions: Maintainance of a tooth in functional activity requires a continual deposition of new cementum on the surface root. . . . Also: The continual deposit of new cementum layers on the root surface must be regarded as in every respect the ideal as not only does it retard the downward growth of the epithelium but it also opposes the enlargement of the periodontal space and the weakening of the suspensory apparatus." The principal fibers of the pericementum are embedded in the cementum, which is formed through the agency of certain cells in the pericementum known as cementoblasts. These cells, which are really specialized osteoblasts, lie on the cemental surface, becoming enclosed in certain regions of the root in the forming matrix, and are termed cementum corpuscles. They are integral components of the pericementum just as are the epithelial cords, principal fibers, fibroblasts, blood vessels and nerves. It would seem logical, then, that the presence or absence of the deposition of cementum, and its quality, must largely depend on the quality of the pericementum

itself and that these most important conditions in reality are phases in the life history of the pericementum and inseparable from it. This being so, it is obvious that the pericementum becomes at once the dominant tissue in the periodontal group, and that the older theories of gingival or alveolar dominance are based on false premises and must be abandoned.

John Oppie McCall, New York City: Dr. Gottlieb has brought to us some new thoughts regarding the normal changes of the periodontal tissues. Without having had an opportunity for further study, I cannot say that I am prepared to accept the theory that he advances regarding the continued eruption of the teeth. This is a new thought to us. Furthermore, some of the changes that he describes as normal, we have come to look on as pathologic. I wish to compliment Dr. Gottlieb on his concept and also on his presentation of this theory. It is a privilege to have this opportunity to come in contact with a man who has conducted such comprehensive researches in periodontal histology and pathology. His contributions at this meeting mark another milestone in our progress toward a clearer understanding of periodontal disease. With regard to hypercementosis, it is a fact that a certain amount of cementum growth is undoubtedly physiologic. On the other hand, we frequently see cases of hypercementosis in which it is very evident that it is the accompaniment of a pathologic process. In either event, it may be safe to assume that the formation of new cementum is the result of a stimulus. So long as this stimulus is physiologic in its nature, we may accept the cementum formation induced by it as being physiologic, but we must remember that pathologic processes also give rise to stimulation and that hypercementosis may equally well be produced as a result of this type of stimulus. I do not, therefore, disagree with Dr. Gottlieb's concept regarding hypercementosis, but I do wish to call attention to the fact that it must be accepted with a reservation as to the necessity for studying the conditions which have called it forth.

QUESTIONABLE METHODS IN THE PRACTICE OF CROWN AND BRIDGE WORK*

By VINCENZO GUERINI, D.D.S., Naples, Italy

As stated in my "History of Dentistry," crown and bridge work was used by ancient Romans and Etruscans; but this prosthetic system was afterwards completely abandoned, perhaps because, in course of time, the serious inconvenience arising from it, particularly *fetor ex ore*, the offensiveness of the breath, came to be fully recognized. But, unfortunately, the abandoned system has reappeared in our times, to bring deterioration and a reflection on our noble profession, owing to many ignorant and dishonest dentists.

And, unfortunately, the prosthetic system of bridge and crown work is apt to favor dishonesty, which is encouraged by the fact that such a system offers the dentist greater gains than the other prosthetic work. Considering only the advantage of the ready made gold crowns that are sold at low prices by the dental depots, many dentists, not to speak of the numerous illegal practitioners, do not recognize the need and the duty of properly learning gold filling and gold inlay work. For every small or incipient cavity, they apply a

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

gold crown, on an almost sound tooth, after committing the sacrilege of mutilating it on all its surfaces. But, alas, it is not this one tooth only that undergoes mutilation: in enlarging the two interstices, these unskillful and dishonest dental practitioners (and unfortunately they are very numerous) also cruelly injure with the file the enamel of the contiguous teeth, thus exposing them, first to the disagreeable sensation of thermal changes, and then to caries. But the evil does not end here. It generally happens that, after it is applied, the gold crown is higher than the natural teeth, and consequently, the dentist grinds the enamel of the healthy antagonizing tooth also, it being impossible to grind the gold crown, because, at the first turn of the carborundum wheel, the crowned tooth would be uncovered, owing to the excessive thinness of the metallic plate with which many manufacturers of dental articles make such crowns. In this manner, the poor patient will suffer injury not only to one, but to four teeth, while, instead, only a very small and durable gold filling should have been made. This absurd and dishonest practice has as its sole object a desire to make money without much trouble.

We ask: What are the consequences of this criminal treatment? Often the crowning of the tooth is the cause of an abscess followed by a fistula. In other cases, alveolar pyorrhea ensues after a certain time, brought about by fibrous foods lodging in the interproximal spaces on either side of the crown and causing irritation. These materials, thus imprisoned in the dental interstices and under the margins of the crown, not only exercise a mechanical action which produces anemia from compression in the gingival tissue, but also exercise a chemical and microbic action, because of fermentation and putrefaction. The peridental membrane is soon attacked, and, in a short time, alveolar pyorrhea develops. The tooth begins to loosen and finally falls away, after the patient has swallowed great quantities of pus, which, as it is well known, may be the cause of so many diseases in the different parts of the body.

It often happens that before the above mentioned complications take place, or during their development, the gold plate forming the crown is worn through on the masticating surface, after a few months, with the formation of one or more holes, giving entrance to food substances such as milk, broth, egg and fish; and thus the poor incapsulated tooth is gradually softened and destroyed by the acids arising from the putrefaction of the substances which have penetrated the crowns.

In this manner, the patient carries in his mouth a small casket of putrid infectious matter, such as no one would be willing to have on his shoe. The mouth, which should be the cleanest part of our body, becomes, instead, a source of infection, where the germs may abundantly develop. Accredited by the dentist, the gold crown has become everywhere a sort of ornamental article. Particularly the people belonging to the lower classes have imagined that they acquire a certain appearance of distinction by ornamenting themselves with a bright gold crown, so that a great many men and women of the lower social orders are delighted to show one or more gold crowns in their mouths. It frequently happens that young girls go to the dentist with beautiful and sound teeth, asking for the application of a gold crown on an incisor, for ornamental purposes. Honest dentists having

a sense of personal and professional dignity refuse such requests. But not so the dishonest dentist, and unfortunately there are many of this type. Without conscience or sense of duty, they spoil the sound and beautiful incisor, hiding it under an ugly and disfiguring gold crown.

Bridgework offers for our consideration damages still greater than single gold crowns do. It often happens that dishonest dental practitioners, to repair the loss of one tooth by bridgework, mutilate two sound teeth in using them as abutments, divesting them partially of their enamel and considerably shortening their crowns. Sometimes the applied bridge is higher than the level of the contiguous natural teeth, and in this case, one error becomes the cause of another. Owing to the excessive thinness of the crowns supporting the bridge, and the ease with which they would be perforated, thus uncovering the underlying teeth, the unscrupulous dentist finds himself compelled to grind the enamel of the masticating surface of the three healthy antagonizing teeth. Thus the patient, who does not even suspect the harm that has been done to him, must suffer the impairment of five sound teeth, for replacing the loss of only one. Nay, we must consider that the unskilful dentist, in enlarging the two interstices lateral to the teeth destined to serve as abutments has also, generally, ground the interstitial enamel of the two contiguous teeth, so that the impaired teeth are then, not five, but seven; a sorry state indeed for the person who has the whim to replace the loss of a natural tooth by a fixed false one.

The seven teeth will soon be subjected to pain and disposed to pulpitis, periodontitis and caries.

Oftentimes, long bridges are applied, forming almost entire dental arches, supported by four or five mutilated healthy teeth, acting as abutments. Now, it so easily happens that one or more of these abutments become affected with pyorrhea—that an abscess develops on the corresponding gum; hence, continual pain results on mastication on the whole bridge, so that the extraction of the affected abutments becomes necessary. And who does not know the ruin that then ensues? Either it is necessary to remove the whole bridge, which is often a problematic and painful operation, or to cut off the part of the bridge embraced by the tooth or teeth to be extracted; and then, after the patient has suffered all of this and paid for it, it will be necessary to replace the lost part of the bridge with a prosthetic piece constructed in the way of a movable plate, entailing additional expense.

Still more frequently, we see bridges of four molars attached to the cuspid and third molar, truely a professional crime. The cuspid with only one root, and the third molar with often a single root, small, conic and frequently in an abnormal position, cannot sustain the pressure of mastication on the vast surface of six crowns. This is the reason why, in these cases, pyorrhea arises, mastication becomes impossible, the bridge soon begins to loosen, and it becomes necessary to remove it, together with the two diseased teeth supporting it. And what shall we say of the false bridges of several molars attached only to a cuspid, there being behind no other molars to afford a support?

Another error committed by dishonest and ignorant dental practitioners consists in making and applying dental bridges that in reality are no bridges,

since they fill the entire space of the missing teeth, and lie in contact with the gingival surface, as if it were a prosthetic plate. These ignorant dentists have not even been enlightened by the example of the river bridges, under the arches of which there is free passage for the waters. Thus, the so-called bridges applied by them are not bridges but dams. It sometimes happens that we see patients affected with swelling, with hemorrhagic inflammation of the gums, owing to the traumatic action and the infection caused by such absurd prosthetic pieces; after the removal of which, a suppurating wound comes to light, and in some cases the alveolar crest is found uncovered, because the base of the metallic dam, after gradually crushing the gum in consequence of the masticatory pressure and the sinking of the abutments, reached the bone. When such false bridges are applied on both sides, the masticatory function is impaired; the patient abandons the use of the tooth-brush because of the pain and the hemorrhage caused by its passage on the inflamed gums; the pathologic products become more abundant; the patient wastes away; the odor of his breath makes of him a person shunned by every one, since his mouth has become as filthy as a sewer, and his life is rendered unhappy, and sometimes abridged.

It is to be wondered at that these unworthy practitioners, taking advantage of the general ignorance of the public in dental matters, have the impudence to apply antihygienic and harmful prosthetic pieces even to persons of intelligence and social position.

But the ignorant, unskilful and scrupulous practitioners are not the only ones to commit crimes of this kind. Among the sinners in question there are also, unfortunately, skilful and respectable dentists. When, for instance, a woman comes to them and expresses the wish to have an artificial tooth fixed, saying that she would like much better to remain toothless than to have a movable tooth in her mouth, they have not the courage to answer with a refusal, as they ought to do, but in order not to lose the client, or from gallantry, yield to the weakness of complying with the request. I have often been amazed to see that an ethical dental practitioner had mutilated a sound central incisor and then imprisoned it in a gold crown, in order to support the artificial substitute for the lost central incisor: which is nearly the same as torturing a sound and innocent man and burying him alive, in order to make him support the statue of his dead brother!

We often see bridges accurately made and quite well applied by good dental practitioners, under which there was at first sufficient space to permit a certain degree of cleaning; but, in course of time, the gum was gradually drawn into the free space, until it reached the bridge, entirely and hermetically shutting all the space, so that there resulted a dam, equivalent in its effects to the above described dam bridges constructed by ignorant and criminal practitioners. In both cases, cleaning and disinfection under the bridge is impossible.

Some colleagues might object that, in spite of all that I have said against bridge and gold crowns, there are persons who, for several years, have had well made bridges in their mouth, and, notwithstanding, are enjoying good health, do not complain of any inconvenience and are satisfied with them. But certainly those who suffer from the offensiveness of their breath will have

to suffer. The few persons that declare themselves content with bridgework can be compared with the alcohol drinkers who speak of the excellent state of their health. The poisoning of their nervous system and the alterations of their arteries are in continual, though silent, progress, and sooner or later there comes a day when delirium tremens, or an attack of angina pectoris, or a grave nephritis, or other serious diseases make their appearance, or when life is suddenly interrupted by an attack of cerebral hemorrhage.

Crown and bridge work cannot be regarded as a scientific system, for it is in opposition to the physiologic laws of hygiene. Nature has made our teeth independent of one another, and this not for a mere caprice, but for wise and sublime reasons that every scientist should know. During mastication, the pressure exercised upon the individual teeth, produces an independent movement of the respective teeth in their sockets owing to the elasticity of the peridental membrane, which acts as a pad between the root and the socket of every tooth. This physiologic movement, though not visible, is proved by the bright facets observable on the proximal surfaces of extracted teeth, and caused by the rubbing together of the teeth in their independent up-and-down movements during mastication, which are similar to the movements of the keys of a piano, under the pressure of the fingers on the different keys.

This physiologic movement is interfered with by the immobilization, and the complete loss of independence of two or more teeth cemented in the crowns of a bridge. The peridental membrane suffers both in the case of abolition of the normal movement of a tooth, and in the opposite case of abnormal augmentation of it. When the movement is abolished, the peridental membrane ceases to receive the normal stimulation that is necessary and indispensable for its nutritive processes and its vitality. It therefore degenerates, and pyorrhea alveolaris is the final result. When, on the contrary, the movements of certain teeth are abnormally augmented owing to the fact that they must support a masticatory pressure greater than normal, the peridental membrane of these teeth suffers likewise, from an excess of stimulation, nay, from a crushing. Its vitality rapidly diminishes, and the final result is pyorrhea alveolaris. If a man does not work at all and takes no exercise, he becomes ill because of inactivity; if he works too much, he becomes ill from excessive activity: both excesses are injurious. The same may be said of the peridental membrane, as well as of any other organ of the body.

I have more than a hundred bridges, some well executed by good practitioners, others badly made by bunglers, of almost all nations. The greater number of these bridges and crowns still keep in them the cemented teeth, whose roots present the most evident traces of advanced pyorrhea; an indisputable testimony. I keep them as relics of ignominy, as evident signs of partial decline of prosthetic dental art.

And still there are practitioners who, in good faith, regard crown and bridge work as a mark of progress in our art. In my opinion, they resemble some one who would maintain that the habit of smoking (so injurious in innumerable cases), and all the follies of fashion, such as the shoes with very high heels and a wedge-shaped tip are to be considered as a progress of civilization.

From the esthetic point of view, bridge and crown work constitutes an aberration. Apart from their psysiologic importance for mastication and speech, teeth are, because of their whiteness, an ornament, thanks to which even persons who are not beautiful may be attractive looking, when in speaking or smiling they show a beautiful, white and clean set of teeth. Not so, when a person, even if beautiful, shows among his or her teeth some gold crowns. The eye is continually attracted by the brightness of these crowns.

Eminent artists when asked their opinion of bridges and gold crowns in the human mouth, have declared that gold crowns and bridges constitute an outrage to esthetics, adding that, while the dentist should possess the art of concealing his own art, according to an ancient and well-known precept, it is painful to see that it is he who reveals the professional secret, the physical defect of his client with a prosthetic appliance which not only manifests to all what the patient would have an interest in keeping secret, but moreover alters the appearance of the face. The dentist who commits such aberrations betrays his sacred mission.

CONCLUSION

Considering that the bridge and crown work system has given bad results; that it favors the development of pyorrhea and oral sepsis, which in their turn may be the cause of serious and even mortal diseases; that bridges and gold crowns give to the breath in most cases a characteristic disgusting odor; that crown and bridge work requires, for its good execution, much skill and talent, and that just those who do not possess these requisites are the most persistent in executing such work, doing so, of course, in such an imperfect manner as to dishonor the profession and injure the health of the patients; that crown and bridge work is not a scientific system for it is at variance with the physiologic laws and the rules of hygiene; that there exist excellent prosthetic means (such as the artistic and splendid Logan crowns and plate work), making it possible to repair the dental losses advantageously and beautifully in all cases, I ask this congress to take this subject into serious consideration and to study whether it is possible, for the good of humanity and the dignity and credit of our profession, to abolish the system in question, thus suppressing the widespread employment of crown and bridge work.

THE RELATION OF BALANCING THE OCCLUSION TO OTHER STEPS IN THE CONSTRUCTION OF REMOVABLE BRIDGEWORK*

By L. W. DOXTATER, D.D.S., New York City

WHEN the teeth, in the performance of their function, acquire an excessive occlusal load, the physical stress transmitted to the root investments becomes greater than these structures are able to withstand. Under such circumstances, disease, sooner or later, will supervene. The question of what is meant by the word "excessive" should be given at least brief consideration at this point. The word is necessarily relative. In other words, stress which may be carried satisfactorily in one mouth may prove disastrous in another. The variable elements are, on the one hand, the magnitude of the force exerted, together with the number of the natural teeth over which this force is distributed, and, on the other hand, the character and extent of the alveolar support.

It will therefore be seen that there is no hard and fast rule by which we can state dogmatically that any specified arrangement of teeth will or will not produce excessive stress.

When occlusal stress is excessive, we apply to this relationship the term "traumatic occlusion;" and when bridge abutments become subject to traumatic occlusion, the usefulness of the bridgework is at an end. The term "balanced occlusion" has been found in dental literature with increasing frequency during the last few years. It may be defined as "the equilibrium of force attained when the occlusal load is equally distributed throughout the points of contact in the movements of mastication." (Dwyer.) It is to be understood that under the term "movements of mastication" are included both right and left lateral movements, and the protrusive movement of the mandible. Since these movements are under the interdependent control of both cusp inclination and condyle inclination, it follows that both of these elements must be considered in undertaking a balancing of the occlusion.

With this conception as a foundation, it will be evident at once that the proper restoration of occlusal harmony in dental prosthesis, whether bridge or denture, can be accomplished only by the use of an articulator of great precision, preferably an adaptable one. On this articulator, study casts of the entire mouth should be carefully placed and used as a guide for the first step in the planning of the restoration; viz., the remodeling of the natural teeth.

Before remodeling any of the natural teeth, we should ascertain whether or

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25,1926.

not the mandible is too close to the maxilla. In nearly every case in which the loss of several teeth has occurred, the remaining teeth are forced out of position and the bite has closed. This invariably results in relaxation of the facial muscles and produces lines and ridges on the face. Closing of the bite also frequently results in a backward movement of the condyles, which then encroach on the external auditory meatus.

Fig. 1.—Cavity preparation.

Fig. 2.—Copper bands in place.

In arriving at a decision as to whether or not the bite shall be opened, we study first the facial lines and contours; the magnitude of restorative operations which may be required in opening the bite, and the possibility of securing a balanced occlusion without opening of the bite. These items are given careful consideration as they relate to each other. In other words, it is not invariably essential to facial harmony or occlusal balance that a closed bite be opened. If it is decided that the bite shall be opened, this is accomplished by means of crowns or inlays, or by the bridgework itself. The decision as to the means to be employed will favor that method which will involve the least destruction of tooth substance consonant with the achievement of a balanced occlusion.

In cases in which the bite is already nearly normal, remodeling of the natural teeth which are in traumatic occlusion is the first procedure. By a careful study of the casts on the articulator, we are able to determine which teeth are out of occlusal harmony. The articulator is particularly valuable in studying the occlusal relationships of the lingual cusps, since these relationships cannot be seen in studying the teeth in the mouth.

In remodeling the natural teeth, we should first note those teeth which move when the patient moves the mandible as in mastication. After reducing the

cusps on these teeth, until no further movement is perceived, we should look for blanching of the gums at the gingival margin when the teeth are brought together with force. After all points which have produced movement perceptible to the eye are reduced, carborundum powder mixed with glycerin is placed on the cusps of the teeth and the patient is requested to close and perform the movements of mastication. This will rapidly wear down any remaining points having slight incoordination.

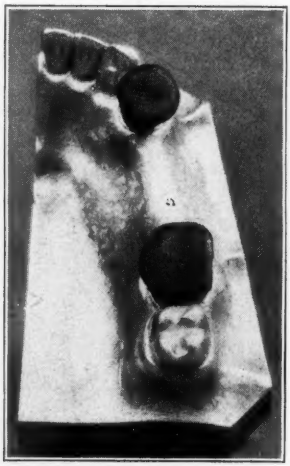


Fig. 3.—Modeling compound forced into teeth and held in place by copper bands.

We are now in a position to proceed with the prosthetic restoration. The next consideration is the relation of the saddle or saddles to the underlying tissues and the abutment teeth. It is folly to expect an abutment tooth to carry a load greater than the supporting tissues can withstand. For this reason, great care must be exercised in properly placing the saddle on the ridge. The saddle itself, in its relation to any hard

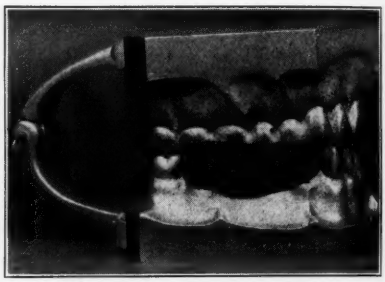


Fig. 5.—Taking of wax bite.

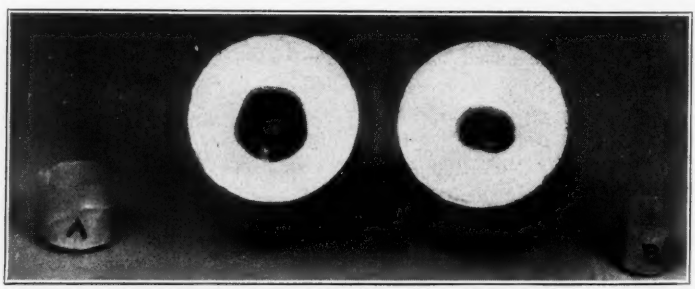


Fig. 4.—Metal rings filled with soft plaster, in which impressions are imbedded.

or high spots on the ridge, must also be given consideration. After a plaster impression has been secured, a gold saddle is swaged to fit the ridge. This saddle is then used to secure a better

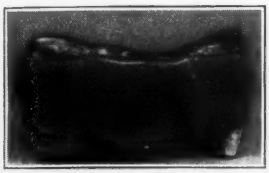


Fig. 6.—Amalgam dies placed in wax bite.

impression. A small amount of modeling compound is placed on the under surface of the saddle and a new impression is taken, the compound being heated to 135 F. The high or pronounced hard spots on the ridge are marked with an indelible pencil, and the compound is dried and replaced over the ridge. The indelible pencil

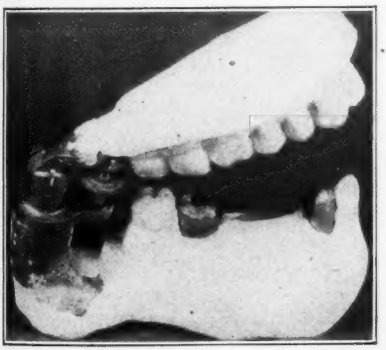


Fig. 7.—Model showing space for reception of attachments.

markings will be transferred to the modeling compound. These spots are then relieved by scraping the impression. Great care must be exercised not to relieve the impression to so great an extent that undue pressure will later be produced on the remaining portions of the ridge.

A new model of artificial stone is poured and the saddle is reswaged to this model. The saddle is then placed in the mouth and held in position, with just enough pressure to seat it properly. With a small impression tray, the anterior abutment and the anterior portion of the saddle is covered with plaster. This procedure is repeated for the posterior abutment and posterior portion of the saddle. After the latter mix of plaster has set, the small

Fig. 8.—Wax patterns ready for investing.

trays are removed, and the saddle will be retained in position. With a larger tray, an impression covering the small impressions already in place is taken, over the anterior and posterior abutments. The combined impressions are then removed *en masse* and a model is poured. The attachments are soldered to the saddle, which is then placed in the mouth, and full impressions are taken, together with a bite.

The models thus secured are mounted in the articulator, which will thus record the saddle and abutment relationships, and also the cusp relationships of such teeth as may have been remodeled. The artificial teeth are then ground into position, and coordination of their occlusal surfaces is established.

It is proper to mention at this point

that, in selecting and modeling the artificial teeth, due attention must be paid to the occlusal anatomy, and in fact to the anatomy of the entire tooth. This will also include proper attention to contact points between artificial and natural teeth, and between adjoining artificial teeth. If these restorations are to function normally, they must be so modeled that such function is possible.

After the bridge is completed, one tooth at a time is placed in position in the mouth, and such further adjustment for occlusal harmony as may be required is made. The need for this further adjustment is dependent on the fact that, in the mouth, we are dealing with tissues the resiliency of which cannot be reproduced by an articulator. The teeth are then cemented to the bridge and the bridge is inserted in the mouth. Carborundum paste is placed on the occlusal surfaces of all the teeth, and the patient again performs the movements of mastication, in order to develop occlusal planes which will harmonize with the condyle paths.

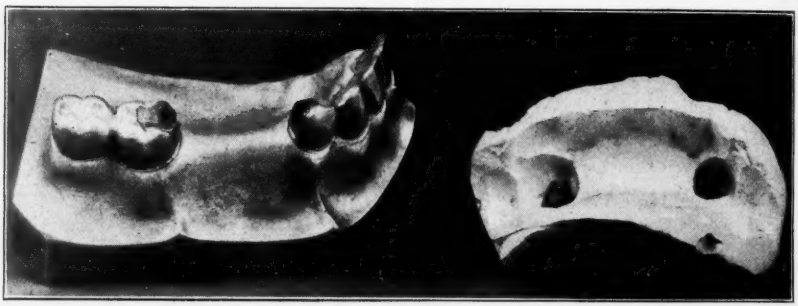


Fig. 9.—Plaster impression.

There has been no outstanding contribution in the field of bridgework during the past year. But it is significant that, in this field, there has been a unification of the views of the profession regarding the part which traumatic occlusion plays in the failure of bridge cases. For many years, it has been the belief of bridgeworkers that their failures were caused chiefly by overloading the abutments. Many bridges of short span have failed, not because of an excess of vertical occlusal stress, but because the incoordination of its occlusal surfaces brought this stress to bear on its abutments in such directions as literally to tear them from their foundations. This has been called excessive lateral stress. This view is accepted both by those who argue against fixation of abutments, and by those who believe that fixation of abutments is not in itself injurious.

It is interesting to note the attention which has recently been given by full denture workers to the problem of securing what they term a "balanced occlusion." While we cannot employ the term "traumatic occlusion" in connection with dentures placed in an edentulous mouth, occlusal incoordination similar to that which produces traumatic occlusion in the natural dentition is fre-

quently found in full dentures. And this lack of occlusal harmony will be disastrous, as regards the success of the dentures, just as is its counterpart in its effect on the periodontal structures. It

Fig. 10.—Model of artificial stone.

is but natural, then, to expect that, if the full denture prosthetist finds it advantageous to employ an articulator with which he can reproduce the mandibular movements of the individual patient, the bridgeworker may find the same method applicable to his work.

Fig. 11.—Wall of "plasteline." *A*, outline for saddle.

Experience in the adjustment of occlusal inharmony of the natural teeth in the treatment of periodontal disease has made it evident that the supporting structures of the teeth are sensitive to the most minute variations from the normal height and contours of the inclined planes. If we are to use an articulator as an aid in this adjustment, how much more important it is that an instrument of the highest precision be employed in securing the proper occlusal

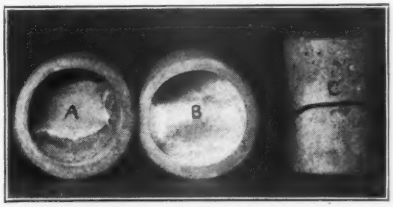


Fig. 12.—*A*, model for saddle imbedded; *B*, one part of swaging die; *C*, counter die.

contours in our bridge restorations. It is known that many of our most successful bridgeworkers have been constructing their restorations on articulators in which were mounted complete casts of the mouth. But only recently has it come to our attention that some of these specialists are utilizing this method not only in the construction of

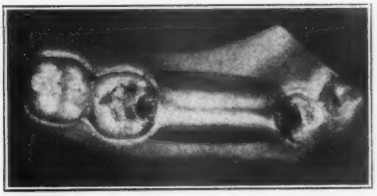


Fig. 13.—Gold or platinum cut to fit outline of saddle.

the bridgework, but also as a guide for the remodeling of the natural teeth, so that the entire mechanism may attain the fullest exercise of its functions.

In the field of partial denture construction, the element of traumatic occlusion is a dominant factor in determining success or failure. It not infrequently happens that an occlusal

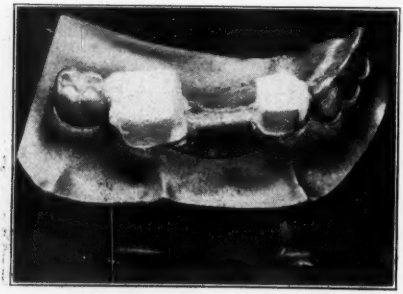


Fig. 14.—Posterior abutment and posterior portion of saddle covered with plaster.

inharmony of the artificial teeth will be transmitted to the natural teeth which are called on for retention. This will inevitably tend to produce disease around these teeth. Disintegration of their supporting structures will be more certain to occur if these anchor teeth are in any degree tipped from their

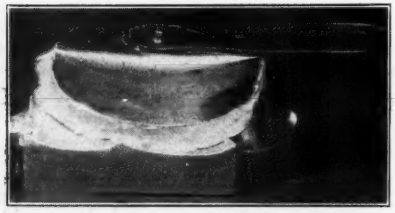


Fig. 15.—Impression covering small impressions already in place, over anterior and posterior abutments.

normal position. This is a point which has received too little attention in discussions on bridgework and partial denture construction. Teeth which are tipped out of the natural positions are always at a disadvantage, even if all the natural teeth are present in the mouth. How much greater will be the disturbance of their supporting structures, when we add to this natural dis-

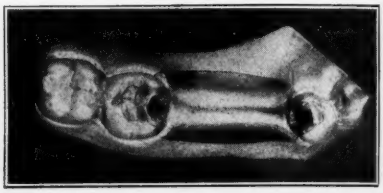


Fig. 16.—Model of artificial stone.

advantage the extra burden which use as an abutment entails.

Faulty occlusion on the supplied teeth will produce an abnormal range of movement of the artificial structure, which may even produce an injury through abnormal pressure on teeth not used as anchorages. This may account for some of the extreme gingival irritation observed in mouths in which partial dentures have been placed.

It is my hope that this paper may be

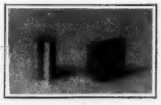


Fig. 17.—Box and spring bar slightly opened.

regarded as a contribution toward progress in the field of bridge construction. In this field, as in all the fields of dentistry, we are constantly progressing. The bridgeworker of today sees his problem in a different light from that of the bridgeworker of yesterday; and

the bridgeworker of the future will undoubtedly register still further progress. Our effort at present is to do the best that we can in the light of the knowledge which is available to us. The conscientious dentist can do no less. It may be urged that the technic herein advocated is beyond the financial capacity of the average patient. With regard to this, I can only say that many people have invested what were to them large sums in bridgework which has failed through traumatic occlusion traceable to cusp incoordination. I leave it to my hearers as to which is the more expensive.

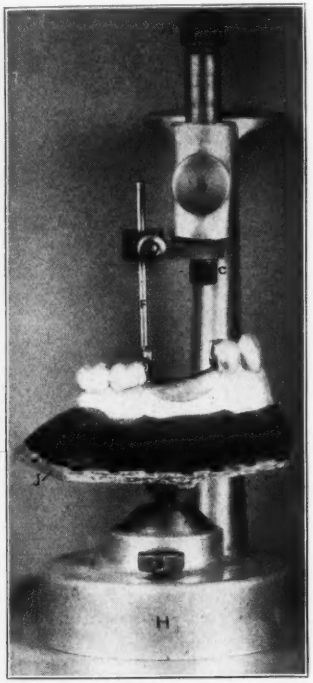


Fig. 18.—The parallelometer. *A*, head of the carrier to which horizontal arm *D* is attached by the knurled nut *C*. *B*, a thumb screw for adjusting the tension on the carrier *A*. By releasing this screw, the horizontal arm *D* can be raised or lowered. *E*, a thumb screw for adjusting tension on the mandrel *F*. By releasing this screw, the mandrel *F* can be raised or lowered. By releasing the knurled nut *C*, the horizontal arm *D* can be moved laterally. *J*, a movable serrated plate. *G*, angle adjustment screw in the base of the survey table *H*. This screw controls the ball and socket mechanism by means of which the serrated plate *J* is held in the base at any required angle.

TECHNIC FOR THE CONSTRUCTION OF REMOVABLE BRIDGE

The cavities are prepared as in Figure 1, sufficient depth and marginal

Fig. 19.—Pieces of clasp wire waxed against side of platinum box.

extension being secured to accommodate the platinum box of the removable attachment. Copper bands are cut to fit the teeth and allowed to extend below the gingival margins of the cavities. (Fig. 2.) Modeling compound is heated to the proper consistency and forced into the cavities, being held in place by the close fitting copper bands, (Figure 3). The modeling compound impressions are chilled and removed from the teeth. The excess modeling compound is trimmed away and the impression is wrapped with 26 gage wax sheets. (*A* and *B*, Fig. 4.) Metal rings are filled with soft plaster, in which the impressions are imbedded as shown in Figure 4. Soft amalgam is packed into the impressions and allowed to set

overnight. A wax bite is taken. (Fig. 5.) The amalgam dies are placed in the wax bite (Fig. 6), and a model prepared (Fig. 7).

To assure perfect occlusion, the wax patterns of the inlays are inserted in the

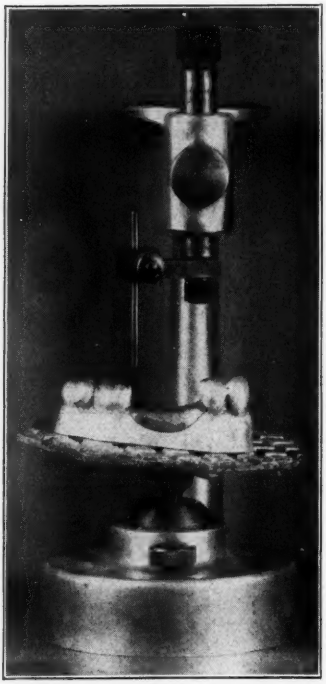


Fig. 20.—Trimming approximating sides of inlays until parallel.

cavities in the mouth, and the patient is requested to masticate. After perfect occlusion and marginal contact are established, the space necessary for the reception of attachments is cut out of the wax patterns (Fig. 7). To be certain that no distortion has taken place, the wax patterns are again inserted in the cavities, and, if correct in every detail, they are invested (Fig. 8) and cast. The inlays are then placed in the cavities and polished. An impression is taken with plaster (Fig. 9), and a model of artificial stone is prepared (Fig. 10).

The outline for the saddle is marked and a wall of "plasteline" is built. (Fig. 11.) The model of artificial stone is oiled and plaster poured into the opening made by the "plasteline." When the plaster has set, it is removed, and we have the outline for the saddle (*A*, Fig. 11). A rubber ring is partly filled with "moldine" and the plaster

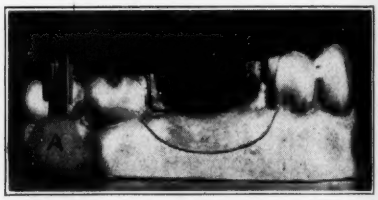


Fig. 21.—*A*, clasp metal with slot; model showing saddle and inlays in place.

model for saddle is imbedded as in *A*, Figure 12. "Dialoy" is poured into a rubber ring, and when cool, separated, and we have one part of the swaging dies, as in *B*, Figure 12. The surface of this die is painted with alcohol and whiting and the counter die, *C*, is poured. A piece of 28 gage 22 carat gold or 30 gage platinum is cut to fit the outline of the saddle, as in Figure 13. A thin layer of modeling compound is placed on the under surface of this saddle and a new impression is taken, the compound being heated to 135 F. The compound is then dried. and any high or hard spots on the ridge are marked with an indelible pencil. The impression is placed over the ridge, and the indelible pencil markings will

be transferred to the modeling compound. These spots are relieved by scraping the impression. A new model of artificial stone is poured and the saddle reswaged to this model. To prevent trauma of the tissues at the

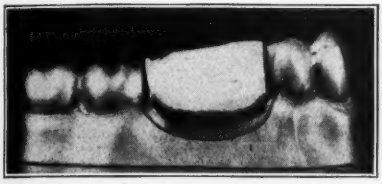


Fig. 22.—Clasp metal forks waxed to saddle and covered with plaster. Part of the saddle is left exposed.

gingival margins of the saddle, a small piece of wax of about 19 gage thickness is placed over this area on the model before the plasteline wall is made, to secure the plaster counter die for final swaging. The saddle and inlays are then taken to the mouth, and the saddle is held in position with just enough pressure to seat it properly. With a small impression tray, the anterior abutment and the anterior portion of the saddle is covered with plaster. This procedure is repeated for

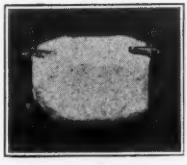


Fig. 23.—Inlays and saddle removed from model.

the posterior abutment and the posterior portion of the saddle, as in Figure 14.

After the latter mix of plaster has set, the small trays are removed, and the saddle will be held in position. With a larger tray, an impression is taken covering the small impressions already in place, over the anterior and posterior abutments, as in Figure 15. The combined impressions are then removed *en masse*, and a model of artificial stone is poured (Fig. 16).

The attachments used in this bridge are Gollobin spring bars. Figure 17 shows the box and the spring bar slightly opened.

The model with inlays in place is waxed onto the movable serrated plate

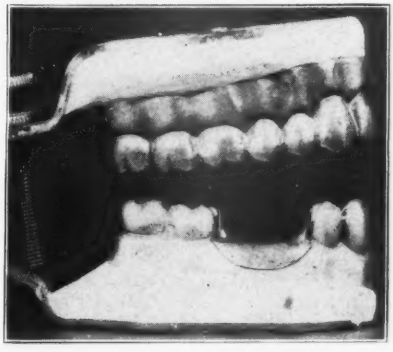


Fig. 24.—Parts assembled on model.

of the parallelometer (*J*, Fig. 18). A mandrel (*F*, Fig. 18) that fits the platinum box is selected and attached to the horizontal arm (*D*) of the parallelometer by a thumb screw (*E*).

The angle adjustment screw *G* is loosened and the plate *J* manipulated until the box of the attachment is firmly seated in one abutment of the model. The angle adjustment screw *G* is tightened and the box sealed into the inlay with sticky wax. The thumbscrew *E* is loosened and the mandrel *F* removed. The mandrel is selected for the other attachment, if it is a larger size, and is attached to the horizontal

arm *D* by the thumbscrew *E*. To bring the other abutment under the point of the mandrel, the survey table *H* is made to slide on the floor of the parallelometer, but the angle adjustment

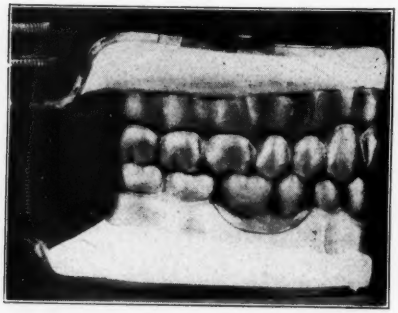


Fig. 25.—Porcelain teeth ground into position.

screw *G* must not be loosened, as it has been set at the angle to which the attachments are to be paralleled. The mandrel is raised or lowered by releasing the thumbscrew *E* until the box is properly seated in the other abutment, then sealed with sticky wax. The mandrel is removed and the boxes are soldered into the inlays. To prevent contraction or expansion in soldering, a piece of graphite is placed in the box and two pieces of 17 gage clasp wire

are waxed against the sides of the platinum box (Fig. 19). Investing and soldering are done with 22 carat solder. After the platinum boxes are soldered into the inlays, that part of the platinum which extends out of the inlays is

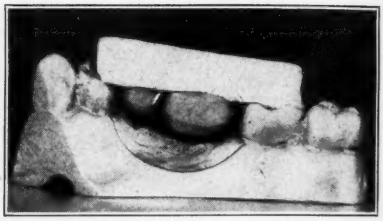


Fig. 26.—Taking of plaster index.

trimmed away, the inlays are placed on the model, a mandrel with a flat side is selected and the operator continues to trim the approximating sides of the inlays until they are parallel (Fig. 20). Any sharp edges of the platinum box are removed with fine disks, and the spring bar is forced into the box. The spring bar is grasped with a pair of pliers and the operator, holding the inlay in the left hand, removes and replaces the spring bar until the spring bar will slide into the box with very little friction. To attach the spring bar

Fig. 27.—*A* and *B*, "moldine," in which teeth are imbedded; *C*, porcelain tooth; *D*, metal die for swaging platinum to fit porcelain teeth.

to the saddle, a slot is cut in a piece of clasp metal No. 1, wide enough to accommodate the spring bar and long enough to reach the saddle (Fig. 21, *A*). With the saddle and inlays in place on the model, the operator slides

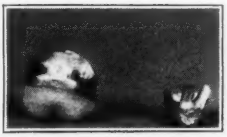


Fig. 28.—Clasp metal pin inserted and soldered to platinum floor.

the piece of clasp metal with the slot over the spring bar until the clasp metal is in close contact with the sides of the inlay (Fig. 21). The clasp metal is attached to the spring bar with sticky wax. The inlay is removed from the model and the spring bar is slipped out of the inlay. The clasp metal is invested and soldered to the spring bar with 23 carat solder (1 dwt. of 22 carat solder plus 1 dwt. of clasp metal).

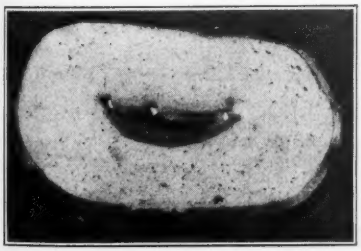


Fig. 29.—Saddle and copings exposed by investing case in metal ring, cutting down investment on opposite side.

After the clasp metal forks are soldered to both of the spring bars, they are placed in the inlays and replaced on the model. The clasp metal forks are waxed to the saddle (Fig. 21), and covered with plaster (Fig. 22), part of the saddle being left exposed. The inlays and saddle are removed from the

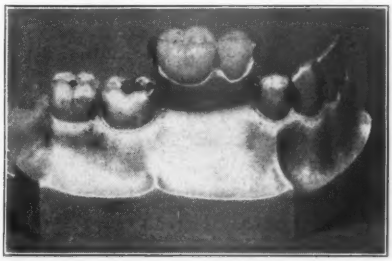


Fig. 30.—Completed bridge.

model, and the inlays slipped off the spring bars (Fig. 23). After investment and hardening, the plaster is cut away and the clasp metal forks are soldered to the saddle with 22 carat solder. All parts are assembled on the model and the spring bar extensions are trimmed away (Fig. 24). At this stage

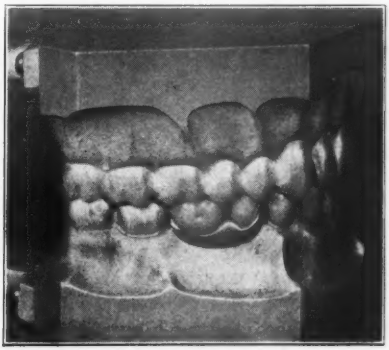


Fig. 31.—Completed bridge.

in the construction of the bridge, it is advisable to call in the patient and place the inlays in the cavities, seeing that

the saddle and spring bars fit accurately. The occlusal surfaces of the inlays are tested to see that no trauma will be produced by the soldering in of the platinum boxes and spring bars. If the boxes and spring bars are in pronounced contact with the opposing teeth, they are ground down until perfect occlusion is established. A new bite is taken and the porcelain teeth are ground in (Fig. 25.) After the teeth are ground into position, sufficient space being allowed for boxing with platinum, a plaster index is made (Fig. 26). The teeth are then imbedded in "moldine" (*A* and *B*, Fig. 27). "Dialoy" or any low fusing metal is poured into the impression to secure a metal die for swaging the platinum to fit the porcelain teeth, as in *D*, which is a duplicate of the porcelain tooth *C*, Figure 27. A 38 gage platinum is swaged to fit the metal dies, then the porcelain teeth are burnished over and the platinum is perforated over the holes in the teeth. The clasp metal pin is inserted and soldered to the platinum floor (Fig. 28). The teeth are placed on the model, care being taken that the pins do not interfere with the proper seating of the teeth. The pins are ground until the plaster index is in place. The platinum copings are attached to the saddle with sticky wax, the inlays removed, and after investment, the platinum copings are soldered to the saddle with 18 carat solder.

By investing the case in a metal ring, the investment on the opposite side may be cut down until the saddle and copings are exposed, as in Figure 29. The case may be completed in one investment, as the solder will flow through to the opposite side.

Figures 30 and 31 show the bridge completed. When the bridge is inserted in the mouth, one tooth is tried at a time and proper occlusion established with the opposing teeth. After the inlays are cemented into position and the bridge inserted, carborundum powder mixed with glycerin is placed on the cusps of the teeth, and the patient is requested to close and perform the movements of mastication in order to wear down any remaining points having slight incoordination.

In cases requiring one bridge of two or three teeth, if the other teeth are in balanced occlusion full casts of the remaining teeth are not necessary when constructing the bridge. If the teeth are not in balanced occlusion, full casts of both jaws are secured and the teeth are ground to balanced occlusion. A small adjustable articulator can then be used for the construction of the bridge. In all other cases in which large upper and lower bridges are inserted or bridges involving both sides, full casts of all the remaining teeth should be used when constructing the bridges.

100 Central Park South.

DISCUSSION

Forry R. Getz, New York City: In discussing dental subjects, particularly in the case of the prosthetic branch, with its almost endless conditions and anatomic forms and with the various methods of technic in making restorations in crown and bridge and partial denture work, long experience is perhaps prone to lead one off on side issues, important enough in themselves, but not strictly a part of the subject in hand. In a general way, it may be said that the discussion of a paper should remain within the limits of the subject as set by the scope of Dr. Doxtater's paper. It adds nothing to the unity of the discussion to bring in a mass of irrelevant matter, personal experience with a list of lantern slides and material equivalent to another paper that might be likened to a mental smoke screen on the subject being discussed. In fairness to Dr. Doxtater, therefore, I shall endeavor to remain within the outline of the subject and be brief. Dr. Doxtater recognizes

the tremendously important part which personal experience plays in prosthetic work when he says that there is no hard and fast rule by which one may go. The various methods and technics are one thing; their application in a given set of conditions with respect to remaining teeth and soft tissues is quite another; and these must be brought together, for the best results, by much work, long personal experience and observation. One of the first steps in practically every case is the elimination of useless teeth. The next is the modification, or in Dr. Doxtater's own words, the "remodeling," of such as require it, to bring them within the condition necessary to a distributed stress and to make a balanced occlusion for that particular mouth. Sometimes, it is advisable to open the bite; often, it is better to leave the bite as it is. Frequently, elongated teeth must be cut off so much that devitalization becomes necessary; either that or extraction. If surgically clean methods of devitalization and root canal filling are employed, I see no reason for extraction. But that is another matter. It is gratifying to see the order and detailed manner in which Dr. Doxtater takes up and secures a balanced occlusion and the important part which an articulator well adapted to the work performs. As an outline of technic, with principles that will apply in almost every moderately bad or advanced case, I can recommend it. For any of limited experience and those just beginning this kind of work, it contains valuable points. There is one thing, which frequently proves to be an obstacle to the restoration and reconstruction of an ideal occlusion, and more so for the younger and inexperienced members; that is, the attitude of the patient toward what appears to him as unnecessary destruction, and it must be handled in a most tactful manner. Even then, it is not always that we can overcome the natural opposition of the patient so that what we can do may be made efficient and serve satisfactorily over a long period. As regards the steps in the technic of actual construction of the type of removable bridge described: There are some cases in which a different method could be substituted with a saving of time; but that is not the point: the question is, is the technic good, will it bring the desired results with respect to abutment adjustment, saddle fit and saddle pressure on the soft and semihard areas of all types of ridges, and is it a technic which a beginner, as well as those having more experience, can safely follow and carry out? I think that it is and therefore suggest no changes. But I wish to speak particularly about the type of attachment used on this bridge, with reference to the conservative handling of noncarious sound and vital abutment teeth. These belong to a group of which the essential features are a split or spring lug, to be received within a box or slide that is set within the contour of an inlay or crown. Each type has its special features to recommend it; each has its place. They are all more or less satisfactory generally, mostly less. Some of them are advocated with perhaps more than purely professional fervor and an interest which is not wholly related and in accord with tooth and pulp conservation. Irrespective of their good and bad points in shape, material and construction, they may be used in crowns and large inlays and where cavities or fillings are already present, and in sound teeth that are large enough to permit the free and extensive cutting necessary to provide for the inlay. Considered from the standpoint of adaptability to the conservative handling of noncarious vital teeth, and particularly small ones, I do not favor them. I mention this only because I know that Dr. Doxtater has not taken any special courses to use any one of them and that he also does use other types of bridge attachments of a more conservative form.

THE VALUE OF FIXED ATTACHMENTS IN TREATMENT APPLIANCES*

By GEORGE W. GRIEVE, D.D.S., Toronto, Canada

THE science of orthodontia is yet in its infancy. The multiplicity of opinions on etiology, diagnosis and methods of treatment is delaying very much the establishment of the science upon a definite foundation. We are traveling over an uncharted course, and often wander into byways which appear to be well trodden, only to find, eventually, that these side roads lead nowhere, and that we must retrace our steps and endeavor to find the straight road which leads on to the goal which we seek. Much valuable time has been lost in this way.

There are conscientious differences of opinion also as to what constitutes a normal denture, some men believing that certain malrelations of the teeth may be normal for certain individuals. Dr. Angle, many years ago, called attention to a definite relation of the teeth, which he called "normal occlusion;" and while we have all found it difficult in many cases to establish and maintain this ideal condition, I see no reason why we, as orthodontists, should relax our efforts to produce a normal denture common to the human race. There are, of course, some extreme malrelations which, by ordinary orthodontic methods, cannot be successfully corrected, but these form a small percentage of the cases presenting in practice.

Previous to 1910, the ordinary expansion arch was looked on as an ideal appliance for the correction of malocclusion. Many of us started our careers with a limited knowledge of this appliance and some form of biteplate. We had high hopes, and for a time felt that we were having wonderful success. At that time it was felt that if we placed the crowns of the teeth in harmony with the "line of occlusion," with their cusps in normal mesiodistal relation, and "retained" these relations for a period of about a year, Nature would so adjust the angle of inclination of their roots that our work would be completed. In an occasional case, our dream came true, but, in many instances, it became evident, shortly after the removal of appliances, that all was not right. We replaced the retainers for a further period, and, with great expectancy, again removed them, only to be met once more with disappointment. By this time, we began to realize that the practice of orthodontia was a more difficult problem than we had thought it to be. We were worried. So far as my own cases were concerned, I thought the fault was mine, and that, in some way, my technic had been at fault. After attending a meeting

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

where apparently beautiful results had been shown on the screen, I would go

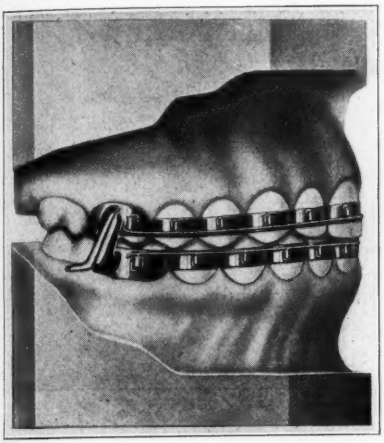


Fig. 1.—Pin appliance.

back to my little practice feeling discouraged, but nevertheless determined

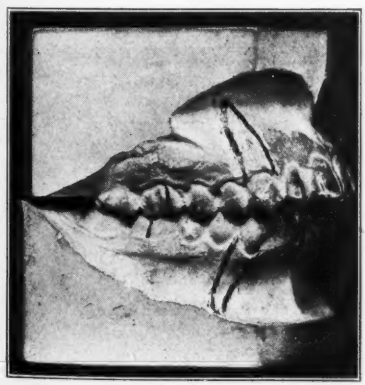


Fig. 2.—Casts in case in which nearly all the teeth have tipped forward.

that, if the other fellow could succeed, I must also, or give up the practice of orthodontia. Let me say now, that pictures of casts and faces on the screen do not tell the whole story; you must have the casts and photographs in your own hands for examination, and must know something of the associated muscles.

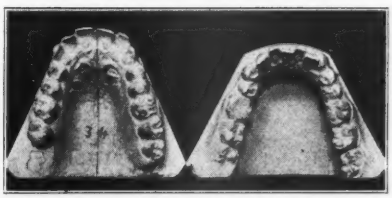


Fig. 3.—Occlusal view of cast shown in Figure 2.

In 1910, Dr. Angle, to whom we all owe so much, introduced what he called the "working retainer." Immediately, I saw the "silver lining," and with great jubilation began to construct and place this appliance on some of my cases

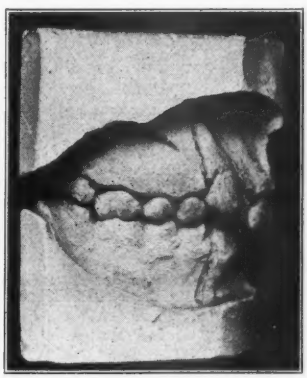


Fig. 4.—Casts showing a deep overbite due to excessive vertical growth in the maxillary incisor region.

in which I realized that Nature had not done what we expected in the adjust-

ment of the angle of inclination of the roots. At first I was unable to obtain the beautifully made parts, so made the appliance as well as I could from iridio-platinum wire. A new day had

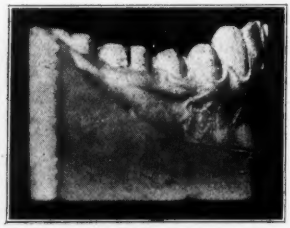


Fig. 5.—Cast in case in which there was too much vertical growth in the mandibular incisor region.

dawned, and the sun was working overtime, as it does during the summer season at the "top of the world." Dr. Angle had solved at least one of our problems. The "working retainer" soon became an active treatment appliance—the pin and tube appliance, the history of which Dr. Young so ably

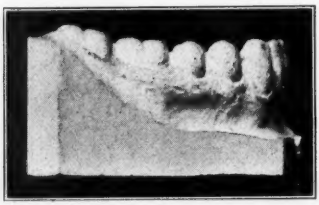


Fig. 6.—Cast of case shown in Figure 5, after correction.

presented in his paper last week before the First International Orthodontic Congress at New York.

There are so many malpositions which teeth may occupy that an efficient appliance for the correction of malocclusion must possess qualities which enable the operator to obtain the necessary an-

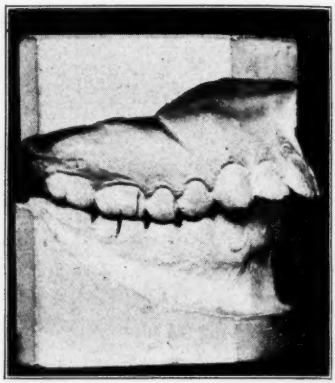


Fig. 7.—Original casts.

chorage to carry out all movement of teeth required. The ordinary expansion arch or the lingual wire do not, in my opinion, possess this particular quality to a degree necessary for the successful

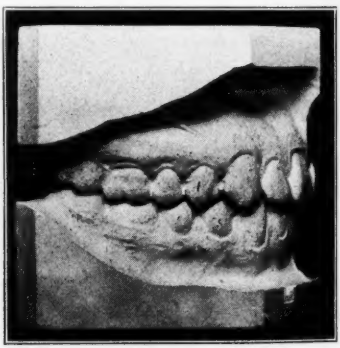


Fig. 8.—Casts of case shown in Figure 7, after correction.

treatment of the large majority of cases. The latter appliance is a favorite one from the standpoint of the

patient, because it is inconspicuous. Its use, in conjunction with the Lourie high labial arch, enables an expert operator to obtain many of the desired movements; but even the combination of these two fall far short in obtaining maximum anchorage for a multiplicity of movements. The ribbon arch also has its limitations, although it far exceeds the former in efficiency, but the pin appliance (Fig. 1), with the auxiliaries which may conveniently be

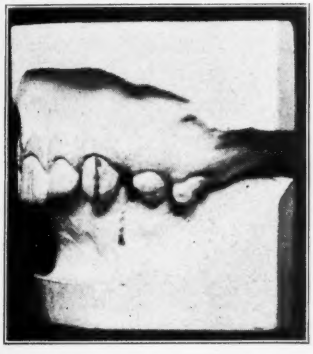


Fig. 9.—Buccal view of case in which all the first molars were badly broken down.

utilized with it, has no peer. It embodies, to the fullest degree, the quality of "fixed attachments," as well as all the other requirements of an efficient appliance. It is, of course, conspicuous, but it is not in the best interests of our patients to sacrifice efficiency for a less important feature. We should endeavor to obtain the best possible results in the treatment of our cases, and to do so we must use an efficient appliance. On completion of treatment, if the teeth do not occupy their normal relation to the apical base or are out of harmony with the "line of occlusion," or their roots are standing at an abnormal angle of inclination, there is no stability to the denture, and, sooner or later, our work may prove to have been a failure.

The successful use of the pin appliance necessitates an exacting technic, which is not beyond the possibilities of the average painstaking operator who will work diligently with it year after year. Difficult cases cannot be corrected with simple appliances, so why endanger any reputation we may have, as orthodontists, by endeavoring to do something which is impossible? Where our efforts fail, the science of ortho-

Fig. 10.—Occlusal view of case shown in Figure 9.

dontia suffers. It will only be through the earnest endeavor of the workers in this fascinating field that the science may some day stand upon a sound foundation.

Three former papers which I have presented within the last six years, and which may be found in the literature, cover the technic to which I have become accustomed in the use of the pin appliance. I would like to say here, again, that I believe too light an arch wire is a mistake, 0.030 inch being the diameter best suited to the average case, with wire as heavy as 0.032 inch where a great deal of bodily expansion is required. Heretofore, I have advocated the use of half-round tubes 0.08 inch long, but I desire now to go on record

that I believe, with Dr. Young, that where possible, we should use tubes 0.10 inch long. The tubes stretch slightly, eventually permitting too much play of the pins, and allowing the teeth to tip, which is undesirable. In my opinion, most of the detail movement should be made with auxiliary springs, all of which has been explained in former papers. With this appliance, properly constructed and handled, the maximum anchorage may be established

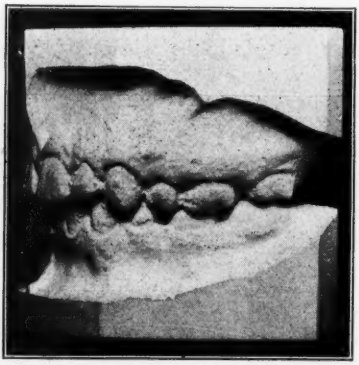


Figure 11.—Casts of case shown in Figures 9 and 10, after correction.

and every desired movement of the teeth obtained, including bodily movement, tipping, rotation, intrusion and extrusion. There is no limit—it will do it all, if the operator masters the technic of its adjustment.

In the treatment of every case, the diagnosis must be carefully made before any appliance is placed and the casts properly trimmed and marked to show what migration of the teeth has taken place, and the operator must at all times keep his eyes open so that the appliances are set to do what is required of them.

Diagnosis is probably the most important factor in orthodontia. If we err in this, we cannot expect to succeed in treatment. I believe that the most constant trend of the migration of teeth is forward, and that many of our difficulties in treatment have been due to a lack of realization of this fact. This mesial drift of the teeth is often associated with a lack of lateral growth of

Fig. 12.—Patient in case illustrated in Figures 10 and 11.

the bones. The tendency is for the teeth to tip rather than to move forward bodily, although the latter condition is often found. In my opinion, in only a small percentage of cases do we find the cuspids, bicuspids and molars distal to their normal position upon what Lundstrum has called "the apical base," except in the maxillae in cases of Class III (Angle).

Figure 2 shows the casts in the case of a young woman, aged 24, in which nearly all the teeth, both maxillary and

mandibular, have tipped forward. The outline of the roots of the cuspids has been traced with a pencil on the casts to illustrate this point more fully. In this case, we have a protrusion of the maxillary teeth, associated with a slightly short mandible. Thirty-two teeth had erupted. Figure 3 shows the occlusal view. The maxillary right third molar, through an error in making the casts, was obliterated. Four teeth had bad abscesses—the right maxillary right

Fig. 13.—Casts of Class III case.

cuspid (which also carried a crown), the left first molar, the mandibular right second bicuspid and the left first molar. These teeth were all removed, and the spaces have been closed. The treatment of the case has not yet been completed, and, in my opinion, it would have been folly to attempt its correction without the removal of any teeth, even though all had been vital and in good condition. When one is called on to treat such a case as this, he realizes fully the value of fixed attachments in treatment appliances.

Figure 4 also shows forward tipping of some of the teeth, but is intended here to illustrate another condition. This patient did not have what I call a close bite, but had a deep overbite, due to excessive vertical growth in the maxillary incisor region. In many cases of this type, the roots of the maxillary incisors are too far forward, and must be carried lingually, as well as intruded, this changing considerably the angle of inclination. Otherwise, a

Fig. 14.—Patient in case illustrated in Figure 13.

normal overbite cannot be maintained. These movements can best be carried out by the use of fixed attachments.

Figure 5 shows the mandibular cast of another case in which there was too much vertical growth in the mandibular incisor region, but this patient, also, did not have a close bite. Figure 6 shows the mandibular cast after correction. Figure 7 shows the original casts, and Figure 8, those after correction. In this case, the appliances were removed in July, 1925, and although the young lady is not yet absolutely a normal

breather, there is no apparent change taking place, so far, except the very slightest tipping forward of the maxillary incisors, which could be accounted for by the lack of normal lip function. There is no tendency toward a recurrence of the excessive overbite. I started the intrusion of the mandibular incisors and cuspids by the use of individual bite-planes on the maxillary incisors; which I later discovered was not the best procedure, as it would have been better to have used springs. This I did eventually, intruding two teeth at a time, and using all the other mandibular teeth as anchorage; which illustrates, again, the value of fixed attachments. However, the use of the planes facilitated the establishment of conditions favorable for Nature to correct a slight lack of forward growth of the mandible.

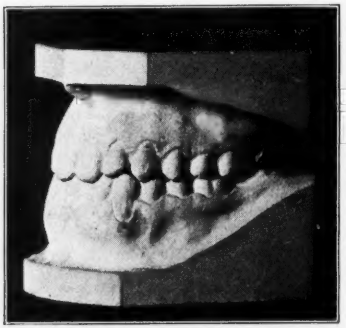


Fig. 15.—Casts of case illustrated in Figures 13 and 14, after correction.

Figure 9 shows a buccal, and Figure 10 an occlusal, view of the original casts of another case, in a boy, aged 13½, in whom all first molars were badly broken down, the crowns of those in the mandible being almost entirely gone. There were four bicuspids missing congenitally, as well as all third molars. The first molars had to be saved at all costs. A pin appliance, with incisor planes, was adjusted in March, 1923, the first molars being previously treated and canals filled.

Fig. 16.—Appearance of patient shown in Figure 14, after correction.

There was a close bite. The molars were built up with amalgam immediately on the placing of the planes, but not fully to occlusion, as some vertical growth of bone was necessary in the mandible, more particularly in the region of the molars. There was some lack of forward growth of the mandible also, which Nature soon looked after when conditions were made favorable by the use of properly con-

structed planes. In April, 1925, the incisor planes were removed and buccal planes placed, the latter being more efficient in obtaining forward growth of the mandible. The appliance was removed from the maxillary teeth in December, 1925, and from the mandibular teeth in January, 1926. No retainer of any kind was used. Figure 11 shows casts made in April, 1926. Several little details were not carried out, as the boy lived some distance from Toronto, and his mother was anxious for the completion of the work. The left maxillary cuspid, for instance, should have been intruded, and the first molars should now have carefully constructed gold inlays. I saw the boy in June, after six months without any appliances, and there seemed to be no unfavorable change. Figure 12 shows a photograph taken in April.

Figure 13 shows casts of a Class III case in a girl, aged 13, in which the maxillary right second bicuspid was absent. Figure 14 shows a photograph. This case also was treated with the pin appliance, and had periods of rest from time to time, to permit Nature to build the maxilla forward. It was found impossible for Nature to keep up with continuous stimulation in this case. The pin appliance was removed from both the maxillary and the mandibular teeth in March, 1924, and a lingual wire placed on the former. The lingual wire has been worn until recently, when a small denture was inserted, carrying a dummy for the missing bicuspid. There were no maxillary third molars. The mesiodistal relations are not quite normal, but it did not seem advisable to endeavor further to obtain an ideal result. There has been no appliance of any kind on the mandibular teeth since March, 1924. Figure 15 shows casts made in June, 1926, and Figure 16, a photograph of the young lady at that time.

These results, I believe, substantially prove the value of fixed attachments in treatment appliances. In my opinion, many necessary details of treatment cannot be accomplished with simple appliances. The ordinary expansion arch has had no place in my practice for many years, and I find the lingual wire really 100 per cent efficient in only about ten per cent of cases.

ORAL SEPSIS*

By GRACE ROGERS SPALDING, D.D.S., F.A.A.P., Birmingham, Michigan

THERE are comparatively few diseases attacking the human organism that have a simple etiology. Misconceptions often arise concerning the relative value of the various etiologic factors involved in the causation of many diseases, for the reason that so frequently attempts are made to consider these factors individually, regardless of the complexity of the etiology. If one attempts an unprejudiced discussion of any of these causative agents, he invariably involves others, on account of their interdependence. This is inevitable in a consideration of periodontoclasia, as its etiology is rarely a simple one. Hence, it is with much misgiving that I attempt to discuss oral sepsis independently of other factors. There is a definite satisfaction in its discussion, nevertheless, for the control of tooth environment is our simplest and, at the same time, our most effectual weapon to combat periodontal lesions.

The first thought in the treatment of periodontoclasia, regardless of the method used, whether it be radical or conservative, should be cleanliness, internal and external. To ignore this principle or to slight it is to delay our progress in treatment, to add to the patient's discomfort, and to handicap ourselves by ineffectual cooperation on the part of the patient. The first step generally taken by the modern physician, when called on a case, is to order a complete cleansing of the intestinal tract. He then requests that it be maintained in a state of cleanliness, knowing that the patient's system must not be handicapped by toxins from waste products, when combating an invasion of micro-organisms. The first procedure in controlling an epidemic or plague is very often a cleaning up. Before a surgeon performs an operation, he recognizes the importance of internal and external cleanliness. In view of the fact that there is so general a recognition of the value of cleanliness in the treatment of disease, it is inconceivable that we can continue to disregard the importance of a clean environment for the teeth as a factor in the treatment of diseases affecting their supporting tissues.

Have we not failed to appreciate the need of giving careful instructions to our patients in personal mouth hygiene and have we not also neglected to place their mouth in such a state of health as would make their own efforts in home care of real value? Because we have failed to meet our dental obligations in this respect, there has arisen a vast army

*The papers of Drs. Spalding, Johnson, MacMillan, Hartzell, Tishler and Williams make up a symposium on "The Etiologic Factors in Periodontal Lesions."

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

of workers who are cognizant of a great need, and are doing all that they are equipped to do in the way of meeting it. While we as a profession have temporarily sidestepped the issue, those that have given the subject serious thought appreciate fully that the employment of dental hygienists is but a partial solution, and at best only a temporizer, to allow us another opportunity to realize our obligations with regard to oral health.

Until all dental patients are educated in the personal home care of the mouth, and have an appreciation of oral health, and are interested in it to the extent of making every effort of which they are capable to establish and maintain it, our services will be incomplete and unworthy of the high calling of dentistry.

Surely, the intelligent daily efforts of many thousands of dental patients is of much greater value in combating diseases of the mouth than those widely intermittent efforts of the dentist or dental hygienist. The greatest opportunity for real service in dentistry today lies in the education of all those whom we serve in an appreciation of the value of health in the mouth, which is unavoidably linked up with cleanliness of the oral cavity.

It is we who are to blame for the many cases of periodontoclasia in the mouths of dental patients, and none other than the dental profession can be held responsible for the uncleanliness of many thousands of mouths seen in dental offices. None of this group perhaps may be individually responsible, but we are members of a profession which is guilty of neglect in this field, and since we have inherited not only the accomplishments of dentistry but its delinquencies as well, it is our obligation to make a most powerful effort to overcome and blot out anything which impedes our progress.

As it is generally considered beneath the dignity of a graduate dentist to perform any operation which can be associated with a cleansing process, the work is generally either not done at all or is delegated to someone else. If the dentist does condescend to do the work, it is all too often done most indifferently, with no other objective than to have it over and done with. Since we are to blame for conditions as they are, we must dispense with prejudices and perform any and all steps that may be necessary to produce and maintain oral health. The rich man's child is not trained to pick up his clothes, toys, etc.; the servants do it for him—an example of false pride. Let us as dentists pick up the errors of dentistry ourselves in its disregard for oral cleanliness and health, and not delegate this to others. May we value our dental inheritance to that extent.

It *is* beneath our dignity to perform dental operations on teeth which are in an unclean environment, which breeds disease. A patient with an unclean face would repel us; how can an unclean mouth be less repellant? The dormant foreign matter which we wash from our hands and face is not in any way to be compared to the active, virulent and dangerous material found in the mouth, which is a definite menace to its health and that of the body. We are so accustomed to uncleanliness of the mouth that we accept it as a matter of course. The teacher in many public schools sends children home if the hands or the face is not clean. The dentist might advisedly send his patients home when their mouths are not clean, provided

he has taught and trained them how to clean the oral cavity effectually.

Since our chief concern in this discussion is tooth environment, it is not alone food remnants or bacterial end-products which should engage our attention. The secretions and excretions of the glands in the mouth (the salivary and mucous glands) make up the fluids with which the teeth are constantly bathed. There can be no doubt that the quality of the saliva has a powerful influence on the health, resistance and recuperative powers of the periodontium. We realize that a definite relationship exists between all the body cells and that metabolism is the basic force back of most conditions of health or disease, this being largely controlled by the endocrine glands, which, in turn, are greatly influenced by the central nervous system. The dentist is held responsible for any deviation from normal in the body which is traceable to abnormal mouth conditions, so why should he not hold the physician responsible for some of the irregular states that we are endeavoring to combat in the mouth? As far as we understand them, it is within our province to aim to control those which the medical man ignores or treats lightly. We know that diet, thorough mastication of food, digestion, assimilation, elimination especially, and mental habits influence the quality of the saliva through metabolism. It would certainly appear to be our duty to increase our knowledge of these subjects to the point where we could give intelligent advice, especially to those patients under treatment for periodontal lesions. Our training has been such as to form an excellent foundation for the advanced study of psychology, physiology, food chemistry and dietetics. The greater our knowledge of these subjects, the greater will be our capacity to serve and treat successfully periodontal lesions.

It is no longer theoretical that the amount of salivary calculus deposited on the teeth is dependent on the quantity and quality of food intake; hence, if we disregard the cause of its formation and treat the condition by mechanical methods alone, we are surely limiting our vision and restricting our services. It is a fact that imperfect elimination, in any or all of its phases, predisposes to disease and is considered by many as definitely associated with periodontoclasia. Is it not then our responsibility to increase our knowledge of the physiologic and dietetic principles involved in elimination to the point where our advice is authoritative and practical? It is a fact that the destructive emotions, by way of the central nervous system, endocrine glands and general metabolism, may produce abnormal secretions in the mouth. Therefore, since the digestion of food and its use in the body, and oral health, may be at times dependent on physiologic processes, is it not essential that we understand and teach sound psychologic principles?

Without bacteria, we would not need to concern ourselves overmuch about cleanliness. We know that without the activities of micro-organisms we rarely have destruction or death of a part. We know also that some bacteria change their character when their environment or medium is changed and that many dangerous types thrive on mouth débris. Since the oral cavity is a perfect incubator for a great variety of bacteria and especially difficult to control because of the presence of the dental organs, it

is reasonable that we should exert a stupendous effort to bring into subjection those influences which have a bearing on the number and types of mouth bacteria.

John M. Riggs recognized the value of cleanliness in the prevention of periodontoclasia, for he wrote "Practitioners should watch the teeth of the young people under their care, and see that their mouths are kept scrupulously clean and healthy." But further argument as to the importance of cleanliness and its relation to periodontal disease is manifestly superfluous.

We have tried to show that cleanliness is not merely dependent on operative procedures but also on applied physiologic, dietetic and psychologic information, the complete understanding of which requires the background of a college education.

The subject of oral sepsis is within the grasp of every progressive practitioner of dentistry, and those who ignore or belittle it or delegate its study to others are definitely blocking the onward march of one of the greatest professions on earth.

OCCLUSION AN ETIOLOGIC FACTOR IN PERIODONTAL LESIONS*

By A. LeROY JOHNSON, D.M.D., New York City

THE question of occlusal trauma is of particular interest to the orthodontist. Since the treatment of malocclusion is dependent on the adaptive processes of periodontal tissue, the institution of an idea that suggests a new light on the interaction of occlusal phenomena and the metabolic processes of the supporting structures of the teeth commands attention. The following is an attempt to present a few of the more important aspects of the problem as they appear to the orthodontist from the occlusal end of the tooth.

The condition referred to as occlusal trauma is involved in two general biologic principles; (1) the law of continuous change with age, and (2) the natural tendency of living organisms to maintain a degree of harmony of parts throughout the life of the individual.

Time means change. During the first years of life, when growth is most rapid, the adaptive powers of periodontal tissue are greatest. Although the relations of the teeth may change or be changed at any time of life, the tissues are more responsive to such changes during growth periods; i.e., the plastic age, when the constructive processes of metabolism are dominant. Later, as age progresses, the same degree of adaptiveness is not evident. In one individual, this cytomorphosis may be rapid; in another, it may be slow. Physiologically, two individuals are not the same age at 14 or at 40 years. Variation is evident in functional processes as in

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

structural form. The time element manifest in the progressive change in the nature of functional activity is a vital factor in our consideration of the nature of periodontal tissue as it relates to occlusal phenomena.

Typical of advancing age is the abrasion of tooth surfaces. The denture of the young adult is characterized by an interlocking of cusps in the molar and bicuspid regions and an overlapping of surfaces in the incisal regions. Time witnesses a wearing away of the cusps and incisal edges, with the result that the entire mandibular series assumes a more anterior position in relation to the maxillary series, the incisors occluding edge to edge. The interlocking of the cusps and the shearing action of the incisors gradually disappear. This change in the occlusal relations is continuous from the time the teeth first come into occlusion. Thus, it is not possible to formulate one scheme of static occlusion that will typify occlusal relations for the entire life history of the denture. Obviously, any concept of static occlusion is inapplicable. From youth to old age, change is the constant factor in occlusal relations. In one individual, it may be rapid; in another, it may be slow.

Thus, there is evident a metamorphosis in the functional processes of periodontal tissue and in occlusal phenomena as well. The changes are correlated. They are of such a character in health, that a harmonious condition is maintained as age advances. The natural abrasion of tooth surfaces results in a diffusion of the stresses the supporting tissues are called on to bear. When the cusps do not wear away, occlusal stresses are too great for the tissues when the reductive processes of advancing years have set in or in the presence of lowered vitality for other reasons. Then, lesions may occur.

This, in a general way, is the logical explanation of the basis of the idea of occlusal trauma. It furnishes no justification for the practice of promiscuous grinding of the teeth by artificial means. Instead it emphasizes the fact that age is a vital element in all diagnosis. The interlocking of cusps is as vital a factor in the health of the denture of the young adult as the absence of locking or the worn cusp is to old age. Grinding cusps prematurely destroys a health factor. The temporary relief afforded by grinding the teeth of an adolescent is not an indication that occlusal stress is a primary factor in periodontal lesions. Rest is, of course, beneficial. It seems to me that the problem which the periodontists and the orthodontists must face in the younger cases is to devise other means of treatment which do not result in mutilation of the teeth. In our eagerness to solve the problem of periodontal lesions at one jump, the natural forms of the teeth should not be maimed without due consideration for the physiologic age.

If occlusion is a primary factor in periodontal lesions, it should be possible to see in occlusal relations the conditions that will cause such lesions before the lesions themselves are manifest. This is possible in cases in which mutilation has taken place as a result of either caries or trauma; and also in which artificial substitutions of unnatural forms and relations subject the teeth to unnatural stresses so suddenly that the adaptive powers of the supporting tissues are not equal to the work thrown on them. In cases of this kind, occlusion is, in a sense, a primary factor in

periodontal lesions. In such instances, periodontal lesions can be anticipated from the study of occlusal conditions.

But in cases of malalinement in which the teeth have not been mutilated or maimed in any way, the problem is more complex. There are undoubtedly conditions of malocclusion so extreme that there can be little question of lesions if the malocclusion is permitted to remain. Nevertheless, the degree of variation in alinement that will predispose to periodontal disease cannot be indicated as readily as some would have us believe.

The concept of normal occlusion is the criterion by which we recognize the abnormal. This seems simple enough until we try to define normal occlusion. I shall not attempt to discuss the problem of the normal in detail. I merely want to give emphasis to certain phases of the question relevant to our present discussion; i.e., can we see in occlusal relations the conditions which will cause periodontal lesions before the lesions themselves are manifest?

The word normal is being dropped in the biologic sciences. Prof. Lawrence Henderson of Harvard University, in an address before the Eastern Association of Angle Graduates, March, 1927, in Boston, said, "There is no such *thing* as the normal. Words like *normal* or *good* or *just* are words we use emotionally rather than objectively. Nevertheless, the physician and dentist must evolve some slight measure or standard." What, then, is to be the nature of this standard?

There are certain general rules evident in the development of the human organism. Yet the range of variability is so great in the forms and relations of parts that anthropologists hesitate to designate anything as abnormal unless it is absolutely dysfunctioning. Morphologic variations are abnormal when they become pathologic. It may be only very unusual; it may not prevent efficient functioning. In fact, it is practically impossible to determine normal forms from statistical reasoning alone. Too many variables are involved and, without a knowledge of all variables, the error is too great to draw conclusions. Statistics furnish us with scientific leads. They do not tell the whole story regarding the functional activity of a part of an individual. We are more vitally concerned with specific than with generic problems. At the present time, in orthodontics at least, it is well to emphasize this distinction.

We must have our ideal scheme of occlusion based on statistical studies. It is absolutely essential. Without it, we have no background to work on. But we cannot suppose that the ideal scheme of occlusion, balanced or otherwise, is the criterion of normality. The ideal is not objective. Approach the problem from whatever angle you will and the logic of facts is against the assumption that there are many instances in which it is possible to see in occlusal relations of the unmutilated denture conditions which are primary factors in periodontal lesions. The recognition of peculiarities in occlusion where lesions are manifest does not justify the claim that occlusion is the cause. Lack of occlusion will result in disuse atrophy of supporting osseous tissue. This is not within the field of our discussion, as the teeth in such cases are not in occlusion.

In the practice of orthodontics, we commonly see undue occlusal stress put on individual teeth. When carried to extreme degrees, periodontal lesions

occur. But they are so rare that we are impressed with the tremendous adaptive powers of the periodontal tissues rather than with its limitations. In a state of health, the tissues adjust themselves to occlusal stresses, intermittent or continuous. Orthodontic practice seems to indicate clearly that lowered resistance of periodontal tissue due to abnormal systemic conditions is more often the cause of periodontal lesions than are purely occlusal phenomena.

The physiologic point of view which utilizes statistical data, and, at the same time, recognizes the limitations of such methods is the attitude of rational diagnosis. The interdependent reactions of the functional processes of the periodontal tissues, and the vital unity of all parts of the individual organism, are biologic facts which show clearly that, in the last analysis, the normality of the denture is determined by the reactions of the whole complex which goes to make up the dental apparatus, rather than by a comparison of the occlusal relations of one person with those of another or with an average. The problem of periodontal lesions involves all available knowledge of the morphology and physiology of the denture and associated parts. Concentration on any one group of phenomena, such as occlusal stress, cannot but lead to erroneous conclusions, and practice based upon it is empiric indeed.

We must see in the positions of the teeth an index of functional activity. In certain body structures, as, for example, the head of the femur, where the form is relatively constant, the physiology is, so to speak, sufficiently solidified to apply statistical methods with quite a degree of success. But, in the case of the human denture, this is not true. Here, inconstant form is the rule; and this inconstancy of form makes it imperative for us to take a more comprehensive view of our problems than can be obtained merely from the study of statistics or mechanics. The development and health of the supporting structures of the teeth are dependent on many factors, some known, many unknown. The force of occlusion distributed through the natural forms of the teeth to the periodontal tissues is without doubt an essential part of the physiologic complex expressed in the development of a healthy dental apparatus.

The question of occlusal trauma from the orthodontic standpoint may be summarized as follows: Until we are in possession of more knowledge than we now have, the safest procedure in the treatment of periodontal lesions is the preservation of natural tooth forms and the study of the functional processes of the tissues which support them. Acute conditions, and the limitations of our knowledge, may necessitate the occasional grinding of a tooth. Nevertheless, the evidence is clear enough that the functional processes primarily at fault are periodontal not occlusal. Grinding a tooth in one part of the arch involves adaptive processes in other regions. Hence, in the presence of periodontal lesions, indicative as they are of impaired function of the tissue, the probability, when grinding, of initiating lesions elsewhere should not be overlooked. It is only with the utmost caution and with keen appreciation of the possible effect that teeth should be ground, and especially is this true during the periods of life when vigorous occlusal stress is essential to normal de-

velopment; i.e., throughout childhood, adolescence and early maturity. In the later periods of life, when the sound of grinding should be low, supply the harmonizing force, if need be, artificially, which in more primitive days was done naturally.

Orthodontics stands for the respect of natural tooth forms, and the serious study of the physiologic characteristics of periodontal tissues. The biologic significance of tooth forms is as vital as the structural constitution of periodontal tissue. They are functionally interdependent. Periodontal tissue, being more responsive to the vicissitudes of life, reflects them more readily than do tooth crowns. Thus, periodontal tissue is more often the seat of the primary factor in pathologic lesions than is the crown of the tooth in the function of occlusion. In the vast majority of cases, occlusion is of secondary importance in the development of periodontal lesions.

NONUSE IN THE DEVELOPMENT AND RESISTANCE OF THE ALVEOLAR PROCESS*

By HUGH W. MacMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

WHILE it is generally admitted that present-day food habits are such that vigorous mastication is no longer necessary and, as a result, the health and resistance of the gums are impaired, the evaluation of disuse as a contributing cause of periodontal disturbances has not been definitely determined. Disuse *per se* does not produce the changes associated with periodontoclasia. It is always associated with many other secondary or contributing factors which are more demonstrable. It is often overlooked in the radiogram unless the diagnostician has a keen appreciation of the appearance of the normal alveolar process and of bone mechanics.

In order to appreciate the rôle which function plays in the determination of the normal characteristics of the alveolar process, it is necessary to review, for a moment, the work which was done by Roux in 1881 and described by Russell[1] as follows:

> There must be distinguished in the life of all parts two periods, an embryonic in the broad sense, during which the parts develop, differentiate and grow of themselves, and a period of completer development, during which growth . . . can come about only under the influence of stimuli. There is thus a period of self-differentiation in which the organs are roughly formed in anticipation of functioning, and a period of functional development in which the organs are perfected through functioning and only through functioning. . . . Form characteristics which were originally acquired in post-embryonic life

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

1. Russell: Form and Function, New York: E. P. Dutton and Co., pp. 320-322, 1917.

through functional adaptation may be developed in the embryo without the functional stimulus, and may in later development become more or less completely differentiated, and retain this differentiation without functional activity or with a minimum of it. But in the continued absence of functional activity they become atrophied . . . and in the end disappear.

Howell,[2] in an experimental study of the effect of stress and strain on bone development, comes to this conclusion:

The answer to the question whether bone growth is entirely independent of the action of stress and strain is . . . shown conclusively by the very much smaller diameter, thickness of compacta, size of trabeculae, and greatly reduced weight of bones largely deprived of the action of mechanical stress and strain.

Arthur T. Legg,[3] in the study of the etiology of bone atrophy, contributes the following:

Under normal circumstances, every part of the body receives exactly as much blood as it has need of, and by dilation of vessels a particular part receives more blood the more active it is, and by constriction a particular part received less blood the less active it is. A resting muscle, for instance, has a relative small supply of blood, but during activity, the quantity increases owing to the widening of the blood stream produced by the vasodilators. . . . This diminished or increased blood supply causes, respectively, the atrophy or growth of a part. Bones as well as soft parts waste or increase in size according to their functional activity.

Allison and Brooks,[4] in a clinical study of the changes in bone which result from nonuse, report:

If the lack of use is during the period of growth, there will be permanent changes in the size and shape of the affected bone. The establishment of use will not result in a sufficiently increased rate of growth to make up for the loss which has occurred during the period of nonuse.

Gray and Carr,[5] in studying the effect of loss of function in the process of bone repair in the dog, drilled a hole from 4 to 5 mm. in diameter in an anterior-posterior direction through each radius. The right fore leg was immobilized, the left remained in use. Two weeks later the right injury showed no change. The left injury was slightly cloudy, which indicated osteogenesis. Subsequent examinations showed a considerably slower progress in healing in the immobilized limb.

The results of the investigations outlined in the previous paragraphs are directly applicable to the cases observed daily in dental practice. The alveolar process, being true bone, registers the effect of stress and strain or the lack of it, as indelibly as the bones of the remaining skeleton. The influence of nonuse in the developing jaws is fundamentally concerned in the etiology of malocclusion and must be recognized in its correction. The repair of fractures and surgical injuries of the jaw is as dependent on functional stimuli as is the successful healing of injuries in experimental animals.

The presence of disuse occurring in the developmental period or later as an atrophy is diagnosed almost exclusively by the roentgen ray. Being a structural change, it is detected only by its

2. Howell: Anat. Rec., 13: 233 (Oct. 20) 1917.

3. Legg: Am. J. Orthop. Surg., 6: 84, 1908.

4. Allison, N., and Brooks, B.: Arch. Surg. 5: 499 (Nov.) 1922.

5. Gray and Carr: Bull. Johns Hopkins Hospital, November, 1915, p. 384.

departure from the normal. May it be explained at this time that the term normal as used in this paper refers to the form characteristics of the alveolar process fully developed under the influence of functional activity. As the correct interpretation of disuse depends on an accurate conception of the normal form characteristics, it will be advisable to discuss briefly some of the mechanical factors involved which furnish the functional stimuli in the second, or postnatal, period of the development of a normal mandible.

The mandible is a lever. As such, it must be constructed to resist bending stresses. Consequently, that part of the mandible anterior to the masseter and internal pterygoid muscles and extending into the bicuspid region is a hollow shaft. Along the superior border of this shaft is the alveolar process. Close examination reveals the fact that the upper or gingival portion of the alveolar process is composed of fine meshed cancellous tissue resembling compact bone. This arrangement of the bone in the form of a hollow cylinder with bone of the greatest density around the periphery of the cylinder is in conformance to the law of bending stress which rules that "to resist bending moment stresses most effectively, the material should be as far from the neutral axis as possible."[6] In addition to providing resistance to bending stress in the molar region the alveolar process is required to provide resistance to the compressive and lateral stresses induced by the teeth in mastication. Compressive stresses of mastication are resisted in the most economical manner by cancellous bone, the larger trabeculae of which are in line with the maximum stresses. The outward, upward, inward excursion of the mandible produces leverage on the buccal plate of the alveolar process as soon as the cusps of the mandibular and maxillary teeth come in contact, the amount of leverage exerted being dependent in part on the depth of the sulci. Cross-sections in the mandibular first molar region show the buccal aspect of the roots to be covered with a dense layer of compact bone, which best resists the great amount of lateral force applied. The remainder of the tooth is surrounded by cancellous bone, which best resists compressive stresses. The texture of the bone surrounding the tooth depends on the number of pounds of pressure exerted in the act of mastication. This has been formulated by Koch in the analysis of the femur when he says: "The thickness and closeness of spacing of the trabeculae varies in proportion to the intensity of the stresses carried by them."[7]

The teeth found in this normal mandible also merit some description. The occlusal surfaces show facets denoting wear or there may be an extensive abrasion of the cusps in extreme cases. This fact might interest those operative dentists who insist on carving embryonic cusps where normal cusps are indicated. (The word normal is used here advisedly.) The interproximal surfaces are worn and highly polished by the constant movement of the teeth against

6. Koch: Laws of Bone Architecture, Am. J. Anat., p. 269, 1917.

7. Footnote 6, p. 267.

each other during function. The independent movement of each tooth as thus exhibited is a beautiful object lesson to those orthodontists who insist on employing a type of retaining appliance which splints the teeth in an entire arch together immovably. The enamel is highly polished and of a denser texture. This phenomenon should be explained by those histologists who believe that the enamel is dead tissue and never changes its physical characteristics. The roots of the teeth are enlarged by the addition of layers of cementum, and thereby a larger base is created over which to distribute the load of mastication. Hypercementosis might be classed as an example of functional adaptation.

In viewing a radiogram of this normal region, the following factors would be noted: 1. An increased resistance of the bone and teeth to the roentgen ray. 2. Abraded occlusal, mesial and distal surfaces. 3. Broadened, club-like roots. 4. A gradual transition in the character of the spacing of the trabeculae of the alveolar process passing from a close-meshed type at the free border to a wide-meshed type as the root apices are reached. 5. Almost entire lack of cancellous tissue in the neutral zone or the area

A B

A, the mandibular molar region of an 18-year-old patient. *B*, the same region from a jaw unearthed in the Peruvian desert. In *B*, the thickness and closeness of spacing of the trabeculae of the alveolar process, the density of the alveolar border, the denseness of the bone between the roots of the first molar and the gradual widening of the cancellous spaces as the neutral zone of the shaft is approached may be noted. The lamina dura is almost indistinguishable owing to the superimposition of the dense bone in its immediate vicinity. The occlusal surface of the first molar is abraded by vigorous mastication. Caries and periodontoclasia are absent. In *A*, the increased permeability of the bone to the ray, the wide meshed spongiosa and hazy trabeculae and the almost total absence of bone between the mesial and distal root of the first molar may be noted. The lamina dura stands out in marked contrast. The blurred alveolar border between the first and second molars has already become decalcified and is breaking down. Fillings and recurrent caries abound. Sharp "embryonic" cusps are present. This patient has had for years careful attention as to diet, intake of calcium lactate and vitamins, and light. Extract of parathyroid has even been employed. Disuse seems to have been the deciding factor concerned in the etiology of the retrogressive changes.

below the roots of the teeth which appears as a broad dark band of lesser density. 6. Superimposition of the close-meshed bone on the lamina dura in the immediate vicinity of the alveolar process to such a degree that it can not be recognized as a "thin even white line."[8] 7. A pulp chamber of decreased size. 8. Infrequent dental caries and alveolar border disturbances.

In comparison with this "normal" film, the radiogram of a similar area in the average patient does not present the evidences of functional activity enumerated above. The bone and teeth are more permeable to the ray. There is not the specialization of the supporting trabeculae of the alveolar process. The lamina dura and the line of the pericementum stand out in marked contrast. There may be an almost total absence of bone between the roots of the teeth. The spongiosa is widely meshed and hazy in outline. Large carious cavities are frequently observed involving the pulp in teeth which present sharp unworn cusps and "embryonic" pulpal horns. The general picture is one of underdevelopment and disuse. Whitman,[5] in discussing atrophy of bone, comments on this condition as follows: "In the X-ray negative, such atrophy is indicated by a loss of clearness in outline, which is replaced by a peculiar blur, resembling closely the infiltration due to disease." Another statement from Whitman[9] of peculiar significance in the treatment of periodontoclasia for patients with this type of alveolar process is that "these nutritive changes explain the delay in recovery after apparently slight injury or disease. . . ."

8. Greenfield, A. L.: Interpretation of Dental Radiographs, Rochester, N. Y.: Ritter Dental Mfg. Co., 1926, p. 2.

9. Whitman: Orthopedic Surgery, Philadelphia: Lea and Febiger, p. 254, 1919.

CONCLUSION

It seems that sufficient evidence has been introduced to justify the assertions that the physical signs of disuse are of frequent occurrence in the alveolar process of patients seeking dental services; that disuse is a definite demonstrable factor producing a lack of development of the bone, and that "lowered vitality of disuse appears effective in increasing the susceptibility of infection."[10] It is not meant to infer that local disturbances do not occur when the alveolar process is "fully developed under the influence of functional activity" because such is certainly not the case. Systemic disturbances such as mercury and lead poisoning can produce lesions in the healthiest gum margins. The withdrawal of certain vitamins has produced periodontal disturbances in experimental animals with presumably normal mouths. It is equally true that local disease occurs in the mouths of otherwise healthy patients who ingest all the necessary minerals and carry out all the requirements known to effect their retention. It is this last class of patients who invariably present in radiographic films the physical signs of disuse; which alone seems to hold the balance of power between health and disease.

The normal development of the alveolar process necessary for increased local resistance is produced only by adequate stresses of mastication received on the occlusal surfaces. Lack of occlusal stress, whether produced by fail-

10. Adami: Principles of Pathology, Philadelphia: Lea & Febiger, Vol. 1, p. 403.

ure to masticate resistive foods or by grinding a tooth so that "it does not meet its antagonists of the other jaw in any of the movements of mastication,"[11] results in disuse and lowered local resistance. In addition to the prevention of other local and general factors concerned in the etiology of periodontoclasia, the correction of disuse by the exercise of as much occlusal stress as can be exerted by well-developed muscles of mastication is one of the chief factors that, in the words of McCollum,[12] "will result in the formation of a dental mechanism possessing its own barriers of defense."

11. Stillman, P. R., and McCall, J. O.: A Text Book of Clinical Periodontia, New York: The MacMillan Co., 1922, p. 52.

12. McCollum, E. V.: The Newer Knowledge of Nutrition, New York: The MacMillan Company, p. 433.

BACTERIA*

By THOMAS BRADFORD HARTZELL, M.D., D.M.D., F.A.C.D.,
Minneapolis, Minnesota

THE beauty, the abstract value and the utility of the earth's products depend on an unseen factor, bacteria; unseen and therefore little thought of or appreciated except by a few who give special study to the problem of the earth's productivity. For the continued power to produce growth exists only coincident with the power to return that growth to the soil.

Nature has made the cycle of growth reproduction and dissolution a continuous process. Were it not so, every leaf, tree, flower or animal body, although dead, would continue to exist in much the same fashion to the end of time. The leaves might lose their vitality, but they never would lose their cellular structure. They might dry out, be wet and frozen and dry out again often enough to break up finally, and find their way back to the soil, but that would be a long slow process.

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session, Detroit, Mich., Oct. 25, 1927.

Take, for example, a meadow with a luxuriant growth at the close of the season. The dead grass upon the earth forms a blanket through which new growth would with difficulty find its way, and, were it not for the disintegrating power of bacteria, it would remain to prevent next year's growth. At the close of the season and the death of the summer's growth, bacteria begin their work. They disintegrate, dissolve and turn back into the soil the organized tissue, thus making possible its reutilization in future growth. This holds true of every single living thing, human and animal bodies as well as vegetable organisms. Sir Mark Ruffer in his "Paleo Pathology of Ancient Egypt" shows human tissues containing bacteria, which would have returned these human bodies to their original element, except for the fact that their growth and multiplication was arrested by embalming.

Ruffer, by softening the tissue with water and then making histologic prep-

arations, finally staining for contained bacteria, shows them in these human tissues. Of course, there is nothing remarkable about that. The remarkable thing is that these micro-organisms have retained their structure and form through thousands of years, owing to the mummification process, and this process also preserved the tissues in which they lived, which would otherwise have rapidly been dissolved by them and returned to mother earth.

It is therefore a tremendous fact that our very lives depend on bacteria, for they make possible soil fertility, thus maintaining the production of foodstuffs for us human beings. It should be kept constantly in mind by the student of pathology that the great destructive agent of all organized matter is the bacterium and that in nature's scheme of things, this organism was intended to live on dead and dying matter to return all cellular structure to the soil from which it sprang; but, like many other plants, it has the power to adapt itself to a changed habitat, and certain organisms have learned to grow in and upon living tissue. When a bacterium acquires this new faculty and begins to destroy the living tissue, it creates lesions, thus shortening the life cycle of the living thing, by what we term disease.

In some such fashion as I have outlined here, we believe that the pyogenic bacteria originated. At any rate, the chief function of them all is to tear down and destroy. Certainly this is true as far as those growing on and around teeth are concerned. The pyogenic cocci invade the gingival crevice and dissolve its lining mucous membrane and its surrounding soft and hard tissues, molecule by molecule. Through the lesions thus produced, they continue invasion until we, at times, find them distributed through the gum tissues, and culture reveals their presence two or three teeth removed from the initial lesion.

During my long and ever-interesting study of the events which take place about human teeth, I can truthfully say that I have never found a lesion in the soft tissue, nor in the hard tissues of the tooth structure, nor in the dental pulp, except only the traumatic lesion, which did not trace its origin to the action of bacteria, either as the result of the action of their waste material or of their digestive ferments. To those who follow the profession of dentistry, who grasp this fundamental fact and create and carry on opposition to the destructive forces of bacterial life most efficiently, will come the greatest measure of success obtainable.

Up to the present time, there are only a few ways that have suggested themselves to us in which to oppose bacterial action. The earliest plan was used by Lister, who destroyed them by chemicals which he sprayed into the air while he operated. He also painted with antiseptics the surfaces of the body where he was about to operate. Then followed the use of a host of germ destroying drugs, such as bichlorid and the like. These are only useful where they may be given contact with the bacteria without destroying the tissues surrounding them. Later on, Wright, Sternberg and others developed the idea of creating immunity through the use of bacterial poisons administered in small but increasing doses, the body overcoming and neutralizing each dose by developing antibodies against them until the blood and tissues accumulated enough of opposing material to enable the tis-

sues to resist the living germ successfully.

This process of immunizing living bodies either human or animal has two limitations: 1. Certain germs do not produce immunity by an attack. 2. Some bacterial poisons are so deadly that they kill before they have time to call out antibodies. More recently, Larson has discovered how to render all bacterial poisons harmless without causing them to lose their power to call out antibodies, thus making it possible to administer enormous doses of toxin without danger, and thereby inducing immunity quickly. To illustrate: Prior to Larson's discovery, we could not administer to a child more than 250 skin test doses of scarlet fever streptococcus toxin as an initial dose. Now, the customary dose of this toxin is 3,000 skin test doses, and he has administered as many as 10,000 skin test doses without harm to the child.

The practical result of this discovery as applied this past year among 20,000 children receiving treatment in Minneapolis has been that only one child in 1,572 thus protected has taken scarlet fever, and these few had the fever in light form. Among the unprotected children, there occurred one case of scarlet fever in every sixty-two.

It would therefore seem that Larson's method of detoxifying bacterial toxins, enabling the rapid production of immunity to bacterial poisons, has given the world one more weapon with which to fight disease. This is a matter for congratulation, in view of the fact that our power to oppose bacterial destruction has been so limited.

This advance step is of more than theoretical interest for dentistry in that we now can utilize Besredka's method safely to produce local immunity with the detoxified living pyogenic organisms which are found in vast numbers on the surfaces of the roots of teeth in deep pyorrhea pockets. I frequently have observed layers of bacteria on the surfaces of the roots of extracted teeth, one fiftieth inch thick, which would easily mean 500 layers deep. These can be reached by sodium ricinoleate in the form of a 2 per cent liquid or in a paste.

This can be pressed in around the teeth by toothbrush bristles, or, in the liquid form, with the blunt nose of the Luer syringe, with vigorous massage driving the detoxified bacteria and their poisons directly into the pyorrheal ulcer which forms the pyorrhea pocket, thus vaccinating it. Besredka claims that when he applied dead scarlet fever streptococci or diphtheria bacilli to the cheek membrane in the form of a poultice, he was able to induce local immunity thereby. He has recently published a book on this subject, and I have collected nineteen of his articles, published in the bulletins of the Pasteur Institute, *Comptes Rendes* and other journals.

The most useful one of these articles is that which appeared in the London *Journal of the Royal Society for Tropical Medicine* and *Hygiene*, volume 17, for the year 1923-1924, pages 346-368. Besredka deals with dead bacteria, which begin to autolyze at once and thus loose their power to promote growth of antibodies, whereas we can detoxify the living germ in its most active state at the site of growth and press it into the bleeding pyorrheal ulcer, losing none of its power to promote the formation of antibodies, but robbed of its power either to destroy or to poison tissue cells. This is a great step forward in our never ending battle

to prevent the ravages of mouth bacteria.

Complete knowledge of the power to induce immunity to bacterial invasion is ardently desired by everyone engaged in the healing arts. Unfortunately, there are many things as yet unexplained and veiled in doubt regarding the development of artificial immunity. From the standpoint of gaining immunity, we can divide bacteria of all sorts into two classes, i e., those which by their action induce a solid immunity to future attacks of the same germ and those which do not, either by their constant presence in a small way or by an enormous dose given experimentally in the form of dead germs, ordinarily called vaccine, produce immunity. No one as yet has been able to suggest or develop a method by which immunity can be induced for this type. Another difficulty which stands in the way of securing vaccines which will induce immunity to the germs which, by their attack, confer immunity, is the fact that they change their character as the mediums in which they are grown is changed. They change their character when transplanted from one individual to another. One individual will develop a mild attack of the disease, and another individual dies with a profound and virulent attack of the same disease induced by the same micro-organism.

Much remains to be done in this field of immunology to develop the science to a point where the greatest benefit may be conferred on mankind.

THE POSSIBLE ETIOLOGIC RELATIONSHIP OF DIET TO PERIODONTAL LESIONS*

By BENJAMIN TISHLER, D.M.D., Boston, Massachusetts

THE purpose of this paper is not to discuss the general subject of the possible etiologic relationship of diet to periodontal lesions, although this was the assigned title, because, as will be shown, such lesions do develop from a nutrient deficiency, but to consider instead those types that are so prevalent in our every-day practice, namely, suppurative and nonsuppurative periodontoclasia. Although investigators conclusively established the connection between a poorly balanced diet and the former disease by animal experimentation, several years ago, no one has succeeded, as yet, in proving this in man. Notwithstanding the lack of definite proof, a great portion of our profession expects that some relationship will be found between them, although nothing has been added to the original findings, and, consequently, any discussion, such as this, must necessarily be in the nature of a hypothesis.

McCollum,[1] in his book entitled, "Newer Knowledge of Nutrition,"

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Session of the American Dental Association, Oct. 25, 1927.

1. The Newer Knowledge of Nutrition, New York: The MacMillan Company, 1922—McCollum, E. V.

chose, as a heading for the final chapter, "The Most Fundamental Problem in Preventive Dentistry." The contents deal with pathologic results due to an improper diet, with caries as the principal theme. In fact, this thought is the dominating one in practically all reports dealing with the subject. During the preparation of this paper, contemporary literature on diet deficiency was searched, for the purpose of studying specific reference to periodontal conditions and, while an occasional one was found, it appeared evident that most writers and investigators regarded the prevention of caries as the greatest problem in the practice of modern dentistry and ignored a study of the periodontal tissues. This, unquestionably, is a grave error; for all well informed dental practitioners realize that the preservation of the integrity of the supporting structures of the teeth is just as important as the preservation of the integrity of the tooth substance.

One of the fundamental requisites of the body cells necessary for the establishment and maintenance of a balanced metabolism is the nourishment obtained from food. Generally speaking, this is dependent on three things: the kind, amount and assimilation of the nutrient material. Any deviation from normal of one or more of these factors is directly capable of affecting the nature of the protoplasm of which all cells are composed. Reference has already been made to the fact that, while general periodontal disintegration of the suppurative type can be produced in animals at will by feeding them on what is recognized as a poorly balanced diet, this result has not been demonstrated in man; in fact, there seems to be much difficulty in doing so. N. Hindehede[2] of Copenhagen referred to this problem last year thus:

> What surprised us most in our experiments was to see how little adult men need vitamins. It shows that rat experiments may easily be quite misleading. If one wants to discover the best food for rats, experiments with these animals are the proper ones. But if one wishes to find the best diet for man, one can hardly escape using men for the experiment. Rat experiments may give some hints but one cannot draw correct conclusions for men.

One of the great difficulties under which many labor in trying to make a comparison between the results of a deficient diet eaten by animals, in a laboratory, and that consumed by human beings, in every day life, is due to the fact that animals, when not in captivity, eat food which instinct demands, for the maintenance of health, but when kept in confinement and given a markedly deficient diet, their body metabolism becomes badly disturbed. On the other hand, civilized man has been living for thousands of years on food chosen for the most part on account of its palatal or visual attraction, which, however, includes some of known nutritive value the effect of which counteracts, in a measure at least, that of other food in which this is absent, thereby deferring or lessening the pathologic results that ensue.

That diet is not the only factor concerned in the etiology of disease is the belief now held by investigators, who have concluded that the biologic problem of cell assimilation must be considered and understood before the problem will be solved. It is now believed that like cells differ in the assimilation of the same kinds of food, and while ingestion

2. Hindehede, N.: Diet and Health, Practitioner, 1926.

may be identical in two individuals, the metabolic results derived from it vary. The solution of the problem is far reaching and involves, among other things, the question of body chemistry, a phenomenon which concerns a selectivity by the cell protoplasm of those food ingredients with which it is capable of uniting.

One of the soundest reasons for the belief that diet has an important influence in the etiology of the forms of periodontal disease under consideration is the fact that a disturbance of function such as results from malnutrition is not a selective action, which operates on certain areas only, as, for instance, that caused by bacterial toxins, because the resulting disintegration is so fundamental, but is one that affects every cell of every tissue in the body. All diet deficiency diseases include symptoms which affect the mucous membrane, pericementum and alveolar process, and while it is evident that there is importance in Hindehede's conclusion that the results obtained from animal experiments in diet deficiency may be quite misleading, when applied to man, it is reasonably certain that they furnish us with some conception of the general metabolic disturbance which undoubtedly takes place. Regardless of the fact that a similar diet deficiency will not produce the same lesions in both animals and man, it is probably safe to infer that, as both function alike physiologically, an abnormal diet of the proper ingredients, for each, may be capable of producing like catabolic changes in both.

Probably the most significant fact, which encourages the belief that the types of suppurative and nonsuppurative periodontoclasia may be due to a faulty diet, is found in a study of scurvy. The symptoms present in this disease are more violent than those of the other types, for the reason already stated, that the food deficiency is complete. In the well-developed stages, the gingivae are fiery red and necrotic with a sloughing of the superficial mucous membrane in the areas where the condition is most marked. They are detached to the depth of the inflamed area and a pocket is formed. Tooth mobility and more or less breath fetor are present. Tenderness and bleeding are pronounced; in fact, gingival hemorrhages are among the commonest manifestations of the disease, according to Hess.[3] In extreme or late cases, the symptoms involve the dorsum of the tongue, the subgingival, sublingual and buccal mucous membrane, which makes the swallowing of food very painful, and death ensues if no effort is made to treat the disturbance. It may be noted that the symptoms present in suppurative and nonsuppurative periodontoclasia differ only in degree from those of scurvy and that a study of the diseases discloses a similarity in the resulting lesions, in that the first visible symptoms are noted in the gingivae and are followed by others in the deeper tissues. In other words, the cell reaction to injury, on which tissue change is dependent, is definitely similar in all the diseases and occurs in the same order.

Any one interested in the subject of periodontology who has ever seen the lesions present in scurvy cannot fail to be impressed with the fact that the dietary factor probably, in some measure, possesses an etiologic importance in the diseases which he is called on to

3. Hess, A. S.: Infantile Scurvy (Barlow's Disease) in Abt's Pediatrics, 1923.

treat. Unfortunately, cases of scurvy are seldom observed in private practice; in fact, many never have the opportunity to see one because the disease occurs so rarely under the conditions in which we live. It was my privilege to see a case about a year ago, which was referred by a dental practitioner for the diagnosis of suspected Vincent's infection, but it hardly needed the bacteriologic examination that was made to exclude this possibility.

That the similarity of scurvy to other forms of periodontal disease is not unrecognized is shown in a quotation from an article written by G. Westin,[4] of Stockholm, Sweden: "It is not absolutely impossible that latent scurvy can present one of the endogenous factors in the etiology of marginal paradentosis." Latent scurvy is the condition present between the period of the first cell change and the appearance of the definite, well marked symptoms which identify the developed disease. (Because of the divergent symptoms present in both phases, it was formerly believed that they represented unlike conditions.) It takes about six months, usually, for the effects of the dietary deficiency to lower cell resistance sufficiently to permit the development of the latter, more pronounced lesions, for at this time bacterial invasion of the blood takes place and infection proceeds rapidly. Here again, we have a direct etiologic parallel between the inception of this disease and suppurative periodontoclasia, for none believe today that the latter disturbance is caused primarily by microorganisms but that a lowered cell resistance always precedes their action.

4. Westin, G.: Scorbutic Changes in the Tooth and Jaws in Man, Dent. Cosmos, 67: (Sept.) 1925.

It would seem that Westin's observation should be changed and the terms a mild or modified form of scurvy be substituted for that of latent scurvy, because they appear to fit conditions more fully. Scurvy is probably as capable of modification as any other disease according to the kind of resistance present in the affected cells; and, as one writer states, "There is a predisposition to scurvy as there probably is in every nutritional disturbance." From personal observation, both in private practice and a school clinic, I believe that a great majority of patients who are affected with advanced periodontoclasia exhibit none of the symptoms of latent scurvy, such as lack of gain in weight, loss of appetite and pallor. In fact, many appear to enjoy apparently good health. The symptom which seems to be most general is that of nervousness, or apprehension due in a great part to the anticipated loss of teeth, a fear which may or may not be justified always.

In reviewing the entire subject, three outstanding points should be recognized:

1. The probability of the dietary factor as an etiologic agent in suppurative and nonsuppurative periodontoclasia may be considered apparent, because similar lesions are present in other diet deficiency diseases.

2. It is now believed that a deficient diet is not in itself entirely responsible for the development of disease but that other factors already referred to are necessary to cause this condition.

3. The lesions present in suppurative and nonsuppurative periodontoclasia occur in the same order as, and are most similar to, those found in scurvy, and it is more than possible that this disease in some mild form may prove to be a factor in our problem.

DIABETIC PERIODONTOCLASIA*

By JOHN BELL WILLIAMS, Ph.G., D.D.S., Richmond, Virginia

DIABETES mellitus is a disease the chief characteristic of which is a disordered carbohydrate metabolism in which sugar is no longer properly stored in the liver and muscles as glycogen but circulates in abnormal quantities in the blood and finds its way through the kidneys into the urine. The classic picture is too well known to require a detailed description. It is attended by dry skin, excessive thirst, marked emaciation and loss of strength. It exists in varying degrees of severity in different individuals and is influenced greatly by race, age and other factors. Unfortunate cases terminate either in gangrene of the extremeties from an arteriosclerosis, or the end comes through total failure of the body chemistry, with the tragic but merciful intervention of coma.

All of these characteristics are perfectly familiar to the physician, but they are far less so to the dentist, and it is from the standpoint of the dentist that I shall endeavor to approach the subject.

In recent years, the subject of diabetes has taken on a renewed interest to dentists owing to the prominence given to infection of the oral cavity in the treatment of this disease. Members of both the medical and the dental profession agree on the importance of eliminating oral sepsis from the mouths of diabetic patients, while some even claim that, as the oral infection subsides, the sugar is correspondingly reduced.

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session, Detroit, Mich., Oct. 25, 1927.

CONTRAINDICATIONS TO EXTRACTION

Another important factor in practice on patients with diabetes is the condition of the urine and of the blood. Unless the urine is free from sugar and the blood sugar is kept within normal limits, wounds in the diabetic may fail to heal. The use of insulin and the regulation of diet by a physician in cooperation with a dentist make it possible nowadays for these patients to have the benefits of dental surgery at any time it may be needed.

ORAL MANIFESTATIONS OF DIABETES

In the early days of insulin therapy, another aspect of diabetes forced itself on me when an internist referred a diabetic patient to me for examination and treatment. This patient, a man, aged 40, was 5 feet 11 inches tall and weighed less than 100 pounds. In his emaciated state, he bore the appearance of walking death. Examination of the tissues about his teeth revealed a startling and unique condition. His mouth was dry, and the four mandibular incisor teeth and the mandibular right first molar were so loose that they could easily be removed with the fingers, while all the remaining teeth were quite mobile. Reddened areas of ulceration were present about all the teeth, particularly about those in the mandible. The gums were dark red, soft and flabby, and presented a picture I had never seen before. In reporting to the

internist, a diagnosis of "pyorrhea" was given, and it was suggested that five

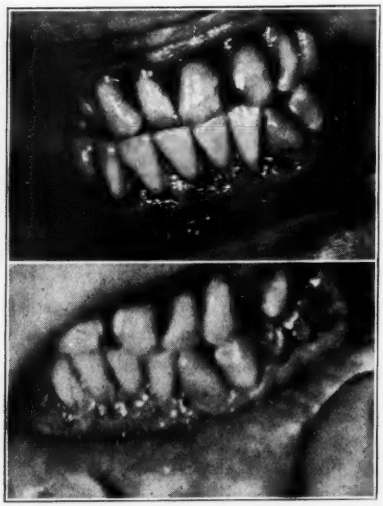


Fig. 1.—Typical Class 1 diabetic periodontoclasia.

teeth be extracted immediately and that a roentgen-ray examination be made to determine whether other extractions were indicated. After a short time, the

Fig. 2.—Far advanced Class 1 diabetic periodontoclasia.

internist stated that the diabetes was under control, whereupon, the loose teeth were removed with little difficulty, and without an anesthetic. A few days later, this patient returned with an ulcer on his cheek opposite the first molar area communicating with the socket from which the tooth had been removed. For some reason, he failed to report for further dental treatment; and as all efforts to locate him were futile, it was presumed that he had left town or had succumbed to diabetes.

With this beginning, the mouths of diabetic patients began to interest me more and more. It was observed that

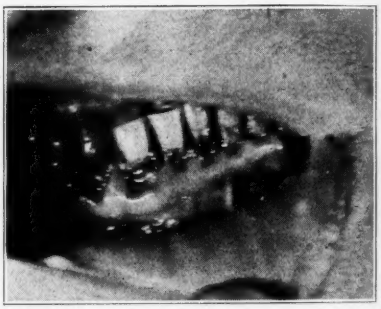


Fig. 3.—Patient shown in Figure 2, after four months diabetic treatment.

about 40 per cent of these patients had lost all the teeth early in the disease because the teeth became loose from what was believed to be "pyorrhea." Invariably, these edentulous patients gave a history of loose teeth, tightening at various times before they became so extremely loose as to necessitate removal. Without exception, these diabetic patients related that the looseness of the teeth was noticed prior to or at the time of the discovery of the diabetes. It seemed a curious coincidence that patients who had been under diabetic treatment for a long time always exhibited a still different aspect of the pyorrheic condition

from those aspects just described, showing great loss of bone around the teeth with little or no gum resorption and little pus formation. These peculiarities of diabetes were carefully noted and meditated on, while, for lack of a more comprehensive method of treatment, each patient was advised to have his teeth removed for "pyorrhea." My studies and experience had bred in me the belief that the general condition is improved by the elimination of all foci. Another departure from the usual appearance of "pyorrhea" was observed in numbers of diabetic patients who had gray areas on the surface of the gums under which was a raw, red area of erosion. This I treated as Vincent's infection, though it varied somewhat from this disease.

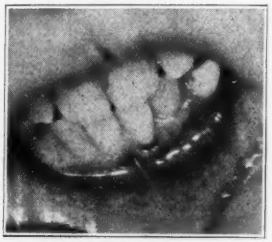


Fig. 4.—Class 1 diabetic lesion in child, aged 9 years.

CLASSIFICATION OF THE DISEASE

The different aspects of these various pictures of diabetic stomatitis at length definitely classified themself into two groups: 1. Patients who have well developed diabetes but have had no diabetic treatment exhibit the following characteristics: The teeth are loose, the gums are hypertrophied, inflamed and dark red, ulcerated and covered in spots with grayish areas of necrotic tissue. This condition resembles pyorrhea, but it is not pyorrhea. It resembles Vincent's infection, but is not Vincent's. It resembles mercurial poisoning, but is not mercurial poisoning. It resembles cancer, but is not cancer. I believe it to be a distinct clinical entity. 2. Patients who have had diabetes for some time and who have been kept under diabetic control exhibit the following characteristics: The teeth are firm; the mucous membrane, while soft, flabby and spongy, presents no areas of ulceration, and the gums, as a rule, have not receded, but there is extensive loss of alveolar bone, together with deep pockets, but with little or no pus formation.

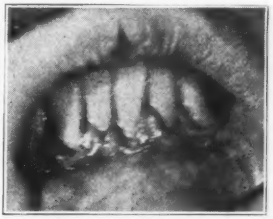


Fig. 5.—Class 1 diabetic periodontoclasia in a youth, aged 17.

These observations and opinions had taken definite form in my mind when, one day, my first diabetic patient, who had had an ulcer on his face after the extraction of a molar, came in. He appeared as healthy as a diabetic could be. It was now four years since his last visit. He bore a scar on his face opposite the mandibular first molar. Examination of his mouth revealed the presence of large deposits of tartar, a dry sluggish spongy looking mucous membrane and gingivae with but slight recession. The reddened and grayish appearance of the gums and the ulcer-

ated spots had entirely disappeared under diabetic control, and the teeth were tight though the roentgen ray revealed extensive loss of bone. The appearance of his mouth further confirmed my belief that he and the other diabetic patients had not had ordinary "pyorrhea," but showed diabetic changes in the oral cavity or, to express it more clearly, changes in the supporting tissues about the teeth simulating pyorrhea but caused by vascular changes as a result of an excess of sugar in the blood. I was so sure by this time that these changes constituted a clinical entity that I wrote letters concerning this malady to several men of the medical and dental professions. Some of the replies were interesting and illuminating. From the Surgeon General's office came the information that two Europeans had recorded such a condition, one in 1899,[1] the other in 1907.[2] On further search for information, it developed that Inglis,[3] in 1908, noted that a predisposition to pyorrhea alveolaris was probable in patients suffering with diabetes. The statement that the teeth became loose in diabetes appears in the Encyclopedia Britannica for the first time in the ninth edition, dated 1877. This information is not contained in the ninth edition, dated 1875, nor in the eighth edition, dated 1853. In an excellent classification of oral manifestations of systemic disease, presented to the National Dental Associa-

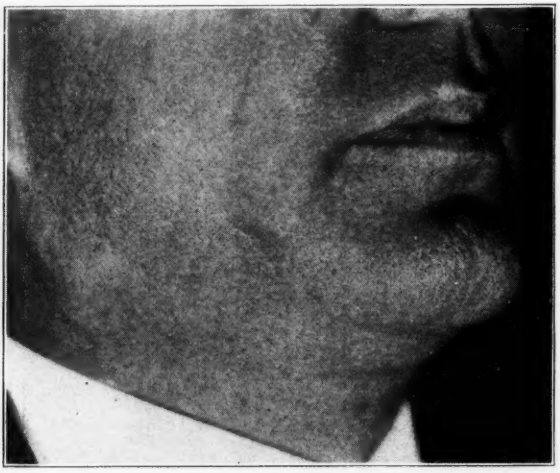


Fig. 6.—Scar on face a result of an ulcer following the extraction of a tooth in a case of Class 1 diabetic periodontoclasia.

1. Grunert: Disease Manifestations of the Oral Cavity in Adults, Berlin, 1899.

2. Port: Manifestations of Diabetes Mellitus in the Oral Cavity, Germany, 1907.

3. Inglis, O. E.: A Text Book of Dental Pathology and Therapeutics, Ed. 3, Philadelphia: Lea & Febiger, 1908.

tion in 1921, Bloch,[4] included diabetic pyorrhea. Ersner,[5] in 1925, recorded the prevalence of pyorrhea in diabetes and stated that, while he had not collected any statistics on pyorrhea associated with other diseases, he believed it more prevalent in diabetes. Winnett,[6] in describing diabetes from the standpoint of medicine, reminds us that glucose flows about in the blood stream and bathes every tissue in the body, making an excellent culture medium for bacteria. Whether his statement that the reason the bacteria thrive is that glucose is actually a culture medium is true or not will have to be left for final determination to the scientists in internal medicine. According to this author, the bacteria of the mouth plus the glucose solution plus small abrasions cause these patients to have "pyorrhea." Their poor resistance is explained by the fact that "their tissues have no come-back." M. L. Rhein[7] introduced this subject to the profession in 1888. In 1894, he presented a classification of "pyorrhea" as follows:[8] 1. Pyorrhea simplex, embracing all cases of purely local origin and requiring only local treatment. 2. Pyorrhea complex, embracing that larger field of more serious disorders and graver affections. Under "pyorrhea complex," Dr. Rhein, at this time,

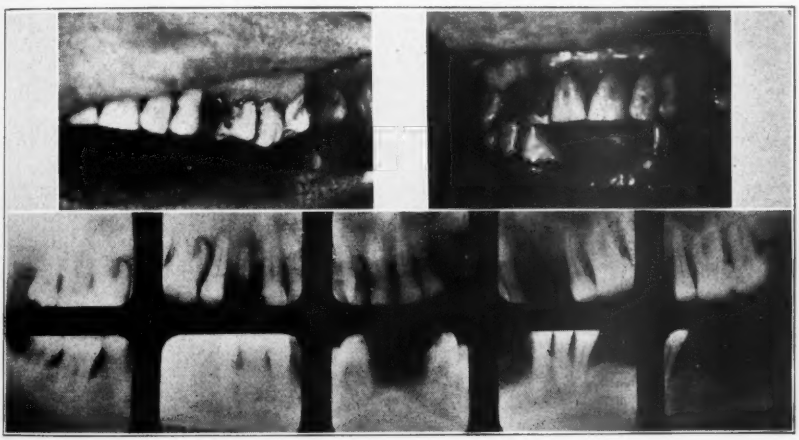


Fig. 7.—Patient shown in Figure 6, presenting a typical Class 2 diabetic periodontoclasia. When seen four years prior to the taking of the photographs and radiograms, this patient's mouth appeared the same as that of the patient shown in Figure 2.

4. Bloch, Harry: Classification of Oral Manifestations of Systemic Disease According to Type, J.N.D.A., 9: 151, (Feb.) 1922.

5. Ersner, Williams: Relation of Diabetes in General and Oral Surgery, Dent. Cosmos, March, 1926.

6. Winnett, E. B.: Oral Manifestations of Diabetes, Iowa Dent. Bull., December, 1926.

7. Rhein, M. L.: Studies of Pyorrhea Alveolaris, Dent. Cosmos, March, 1888.

8. Rhein, M. L.: Etiological Classification of Pyorrhea Alveolaris, read before the American Dental Association, Aug. 8, 1894.

suggested the use of the terms, "tubercular pyorrhea," "anemic pyorrhea," and "diabetic pyorrhea."

CLASSIFICATION OF PATIENTS EXAMINED

A classification of the fifty-eight diabetic patients who have come under my observation gives the data presented in the accompanying table.

The striking similitude of ordinary pyorrhea and diabetes periodontoclasia convinces me that possibly many other patients than my own have lost teeth that

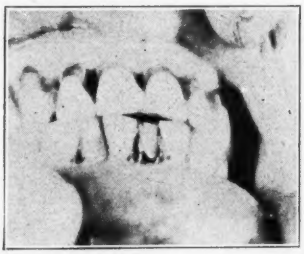


Fig. 8.—Another case of Class 2 diabetic periodontoclasia.

might have been preserved, or have been treated for pyorrhea and Vincent's infection when they should, at the same time, have had treatment by a physician for diabetes. The changes in the color, consistency, shape and character of the gums afford the dentist a possible index to diagnosis. The cooperation of the dentist with the internist will bring about great public benefit, for almost everybody, sooner or later, comes to a dentist, and the dentist's timely diagnosis of unsuspected diabetes will turn many back into the pathway of health.

CONCLUSIONS

1. The infected oral cavity presents certain definite characteristics in diabetics that may of themselves lead to a diagnosis.

2. These modifications of pyorrhea and gingivitis in the diabetic, when closely studied, are so nearly constant as to constitute a definite clinical entity.

3. It would be unnecessary and unwise for the dentist to attempt to diagnose diabetes by these oral changes alone. The safest and simplest method

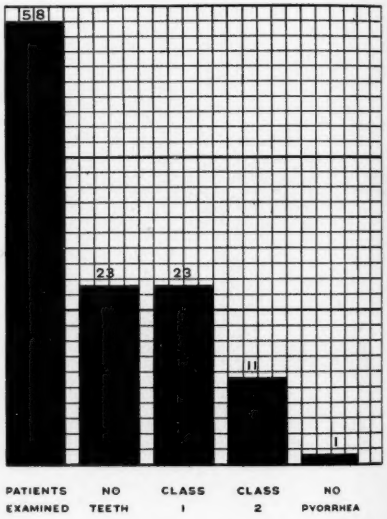


Fig. 9.—Results of examinations of fifty-eight diabetic patients.

is cooperation with a physician in making complete examinations, which, of course, include a metabolic study of the blood and urine.

4. While diabetic patients give a history of periodic loosening of the teeth, we must not be too enthusiastic because other conditions may be the cause of this change. We are warranted in subjecting all patients with such histories to complete medical examination.

5. With insulin and a controlled diet, the surgical procedures necessary to cleaning up foci in the oral cavity can be undertaken with almost the same assurance as in the nondiabetic.

6. The elimination of these foci by the cooperation of the dentist and internist is not only safe but also may actually be the deciding factor in the case.

DISCUSSION

Benjamin Tishler, Boston, Mass.: How do you account for the fact that there was absolutely no gum lesion in one case? Why was one person free and another affected?

Dr. Williams: I can answer that by saying that in my paper I made the statement that I believed these conditions occurred sufficiently frequently to justify the claim that it constituted a definite clinical entity. Beyond that, I cannot go.

G. C. McCann, Danville, Ill.: Dr. Williams has dropped a hint as to what occurs in case a lesion does not develop. When does the patient lose the immunity of the mouth, and the bacteria run rampant? When do we see evidence of irritation? We should try to answer these questions for the reason that it is a known fact that we have certain bacteria in the mouth almost the moment we are born, and some time during our career, we, or a great number of us at least, lose that immunity. What has happened? Dr. Williams said that one of the diagnostic points in diabetes was dryness in the mouth. There is your answer as to broken immunity. Unbalanced and scant saliva is a factor that we should study. The saliva breaks down somewhere and a change occurs. The saliva in proper balance and profuseness acts as a buffer in the mouth. Dr. Williams said that diabetic patients have a dry mouth. I know this to be fact. Dr. Colson, a careful student of this condition, agrees that the saliva change in the mouth comes with this diabetic symptom. He states that the mouth in these cases look pyorrheic. As dentists, we should learn to interpret these symptoms. In the last six months, I have been able to pick out five diabetic mouths, by the change in the gums, that little red mark of circulatory changes, before the patients knew that they had diabetes. In the systemic type, the alveolar crest is an indication. In almost all systemic absorption, we have a uniform, smooth, even line throughout the whole absorbed area. If there is local irritation, we have an uneven crest and more or less bacterial absorption. So there is an opportunity to make a diagnostic differentiation between local conditions and systemic conditions. Where there are systemic disturbances, we should get the patient to the physican. Evidently, not all so-called pyorrhea is bacterial. There are systemic symptoms that show very similiar manifestations, and we should learn to differentiate, and thus to improve our diagnosis, for treatment or extraction.

CLASSIFICATION OF PATIENTS

	No.		Per Cent
Diabetic periodontoclasia, Class 1	20	or	54.5
Diabetic periodontoclasia, Class 2	10	or	17.2
Patients who have lost all teeth	23	or	39.6
Patient with one jaw edentulous (diabetic periodontoclasia in other jaw)	1	or	1.7
Children under 10 years of age	2	or	3.4
Young adults under 18 years of age	1	or	1.7
Diabetic patient with no present periodontoclasia	1	or	1.7
Total	58		

ANNUAL REPORT OF THE DENTAL EDUCATIONAL COUNCIL OF AMERICA

By ALBERT L. MIDGLEY, D.M.D., Sc.D., Providence, Rhode Island

CARNEGIE REPORT

EMBLAZONED in the record of an eventful year in dental education, which has been fruitful in unusual achievement and splendid progress, is the stimulating message from the Carnegie Foundation for the Advancement of Teaching contained in the Bulletin on Dental Education written by Dr. William J. Gies. The history of dentistry reveals no more valuable contribution to the advancement of the science and art of the profession. It ushers in a new era in dentistry, which in historical significance and in practical value will be inseparably allied with the attainments of the year 1839. It inscribes another name on the escutcheon of dentistry to be entwined with those of the illustrious Hayden and Harris.

For a clearer understanding of the report, it should be borne in mind that the Carnegie Foundation is a public trust, interested solely in the promotion of the public welfare, and that it has no officious desire to meddle in the affairs of dentistry or those of any other profession.

Dr. Gies' report clearly blazes the trail which dentistry must follow to raise the professional standing to its ultimate height. It clears the air of many doubts and misunderstandings, giving the reader an accurate understanding of the facts concerning dental education of the present day. The keynote of the report is that better health service can be rendered the public by a close cooperation between dentistry and general medicine and by a thorough revision of the curriculums of dental schools and colleges. It is an educational report and not a technical study of either medicine or dentistry. It emphasizes the fact that dentists are not responsible to themselves alone for the conduct and standards of their profession; theirs is a health service which must at all times be aware of its obligations to the general public. The report stresses the financial needs of dentistry, and also urges the development of better teachers for the instruction of dental students and the promotion of research in universities through effective cooperation between medical and dental teachers and between practicing physicians and dentists.

Of the noteworthy conclusions, one of exceptional interest and value to the dental profession is that dentistry should remain an independent profession and should be maintained on the same intellectual level as other learned professions. All other conclusions of the

study evolve from this fundamental tenet. It is the keystone of the proposed dental educational program, and its effect will be far-reaching, for the obligation of dentistry to advance its professional standing begins here.

For this expressive conclusion and for the keen analysis of why American dentistry is supreme and of how this supremacy is to be maintained and strengthened, the dental profession will always owe a debt of gratitude to Dr. Gies.

The conclusions of the Bulletin are based on (1) the conception that dentistry is primarily a health service, and (2) the conviction that dentistry should be made fully equivalent to an oral specialty of medical practice in service value to the patient. This broad conclusion, which has for its ideal the finest professional service in dental practice, is a call to the dental profession to meet its full responsibility to society. That dentistry will strive for and eventually attain this ideal there is no doubt.

Unfortunately, most universities have hitherto failed to give their dental schools the attention that the serious obligations of these schools require, and the public has not been shown that research work in the field of prevention of dental defects and diseases and expert teaching of the science of dental practice need financial endowments similar to those given so generously to medical schools. The dental profession itself is keenly sensitive to the vision of its future usefulness which is presented in the Carnegie Bulletin, and the improvements therein suggested will soon be realized if the dental schools in the universities can be given the financial support that their great usefulness in public health service warrants. The public must be made to realize that a generous endowment of dental schools will be an assurance of the continued improvement of the health service which dentistry renders to the public.

Immediate and Future Effects of the Report.—The immediate effects of the report have been unusually constructive and decidedly encouraging. Already, it has created intense public interest in the values of dentistry as an essential agency for the promotion of better health service. It has placed dentistry under university control, where it belongs. It has definitely settled the educational needs of the dentistry of the future by proving that it cannot be carried on properly when taught to a man who has had only a high-school training. It must develop on the same collegiate foundation as medicine and other professions.

Officers of universities now realize more than ever before the importance of their dental schools, and they are coming to see that dental education should be administered solely within university walls. They are aware that dental schools must be sustained by funds in addition to student and infirmary fees, that higher standards of teaching must be insisted on, that research must be encouraged, if a university is to be an honorable and useful center in health service education. Officers of dental schools have accepted these added responsibilities and are giving increasing attention to problems that inevitably arise. Formerly neglected libraries are

now being utilized, and are being brought up to date by means of intelligent acquisitions.

The report has already had an excellent influence on the standards of dental licensing examinations. It has inspired in dental examining boards and in the schools a desire for mutual cooperation, to the end that the highest degree of proficiency in practice and a constant emphasis on the health service ideal may at all times thoroughly protect the public.

Dental supply houses now understand that, for the good of the profession, they should withdraw from the field of postgraduate instruction. Owners of privately owned and controlled postgraduate schools and the itinerant vendors of instruction in the specialties of dental education sense a growing hostility on the part of the profession. Dental manufacturers and dealers are becoming aware that their influence on dental literature and on dental journalism is not in harmony with the altruism of this new era, which will not allow the commercial exploitation of dentistry. Throughout North America, dependable practitioners of dentistry have taken courage. They are awake to their responsibilities and are determined to give their full strength to the correction of dentistry's deficiencies and weaknesses.

With dentistry adequately endowed, the future should see marked improvement in the quality of dental teaching, with development of research through a cordial and effective medicodental relationship. The changes now taking place will put dental students on a footing socially and scholastically equal to that of students in all other departments of the university. Practitioners of dentistry will direct their energies toward improving their knowledge of the biologic phases of dental procedure, for they will realize that the mechanical and esthetic phases cannot be developed adequately while the biologic is underemphasized. Activities of the medical and dental departments of hospitals will be coordinated and correlated, and hospitals will feel the need of the dental intern. Public opinion, demanding better health service, will require that dentistry be represented on state and city health commissions and in state, municipal and private hospitals.

Publicity for the Foundation's Report.—Some idea of the extent of the Council's activities in securing wide publicity through newspapers and magazines for the Foundation's Bulletin on Dental Education may be gained from the following facts. More than 1,000 newspaper editors in this country and Canada were urged through circular letters to use their editorial and news columns in giving publicity to the Bulletin. Leading dentists in every center of population in the United States and Canada supplemented these letters by personal interviews with most of the editors. Presidents and secretaries of all state dental societies, editors of state dental bulletins, Fellows of the American College of Dentists, and the members of each state examining board, were requested to lend their assistance. The editors of some prominent periodicals were also interviewed. The results obtained were very satisfactory, and the Council takes this opportunity to thank all those who rendered this invaluable assistance.

Copies of the Bulletin on Dental Education will be sent on request. Address the Carnegie Foundation for the Advancement of Teaching, 522 Fifth Avenue, New York City.

CLASSIFICATION OF DENTAL SCHOOLS

Obviously, the Council's classification of the schools of this country has served an important and useful purpose. Initiated during the late war and at a time when opposing elements were engaged in frequent clashes, the classification was accepted by the schools with little resistance, chiefly because the office of the Surgeon General of the United States recognized the Council as the authoritative body in dental education. The impetus of the initial classification supported by the Surgeon General's office effected an unusual interest in the status and quality of our dental schools, but this interest waned after the war and only became really active on the advent of the investigation by the Carnegie Foundation for the Advancement of Teaching. That the Council has assisted effectively in the elimination of many worthless schools, and in the extinction of many commercialized interests in dental education, is generally understood. That it has encouraged and improved schools that are honestly striving to better themselves, there appears to be no doubt, for it has given them inspiration, incentive and support in their new developments.

In the preface to the Report on Dental Education, Dr. Pritchett says, in relation to the classification of medical schools in the United States by the Council on Medical Education:

> In 1925 there were 88 medical schools in the two countries, 79 in the United States and 9 in Canada. Those in the United States have been graded by the Council of the American Medical Association upon certain adopted criteria into three groups, A, B, and C, there being 70 schools of Class A, 3 of Class B, and 6 of Class C. The artificial character of this classification was pointed out in the Ninth Report of the Foundation. It is illustrated by the widely divergent and somewhat incongruous group of schools that compose Class A. That this attempt at standardization has served to eliminate the more unworthy schools as well as to enlarge greatly the facilities and to strengthen the sincerity of those that remain is clear. The weakness of the classification lies in the fact that it does little to advance the quality of medical teaching and the adaptation of the medical curriculum to the end it is intended to serve.

It appears to many that the present classification of the dental schools is somewhat disappointing. If Dr. Pritchett's statement in reference to the classification of medical schools is applicable also to the classification of dental schools, it logically follows that a more effective and accurate basis of classification should be developed. It is probable that the criteria in our point system can now be reconsidered to advantage and the system brought up to date.

REVISION OF MINIMUM REQUIREMENTS FOR CLASS A DENTAL SCHOOLS

During the past year, the Council has been very active. An important meeting was held in New York City, Dec. 4, 5 and 6, 1926, at which the Minimum Requirements for Class A Dental Schools were revised to meet changing conditions and advancing standards.

Those interested in the development of the Council's requirements for Class A Dental Schools should understand

that the standards set by the Council are the *minimum* standards, and the fact that they are *minimum* standards implies that any school in a position to do so should proceed in advance of those standards as far as their resources and circumstances may warrant.

PREDENTAL EDUCATION

The first step in the correction of of the professional and social status of the dentist rests on the scope and quality of his collegiate education and training. Equality in preprofessional education is the foundation upon which the correlations of clinical medicine and clinical dentistry are to be developed.

The standard of predental education is vitiated in quality and in spirit when collegiate education and training is given in a professional school. Such a practice encourages the idea that anything is good enough for dentistry and tends to uphold the outworn conception of isolation in dental education, which has excluded dentistry from its rightful position in the field of health service. Moreover, such isolation weakens the effort to bring about a cordial and effective medicodental relationship, which is the cement and steel of the dental educational structure of today and the only sound basis upon which capable and inspiring teachers of dentistry may be developed and dental research promoted.

The value of a cultural training in an atmosphere of professional education appears questionable. Out of touch with the academic life of the college and the influences and activities of the campus, which means so much in this formative period of a man's career, a dental student, under such conditions, would be at a disadvantage not only in his undergraduate years but also later as a teacher, research worker or practitioner. One of the causes of the conspicuous absence of dental graduates in alumni activities and their exclusion from such organizations as university clubs lies in the opinion that other graduates and the public hold concerning the dentist's scholastic as well as his professional training. In the past, deprived of the intimate contacts of college life, with his collegiate development restricted by a hybrid type of education, his views of its values unsound, and his training of doubtful value in the minds of his classmates in other departments of the university (this especially refers to the opinion of medical students), the future practitioner of dentistry did not have an encouraging outlook.

If dentistry is to grow in dignity and is to be recognized as one of the learned professions, it must eventually be placed on a scholastic equality with medicine and the other professions, at least as far as preprofessional education is concerned. Predental students should have all the privileges and advantages that are enjoyed by other academic students, especially prospective students of medicine. Such equality is essential in the development of a well-rounded educational health service center. Social and other equality as well as scholastic equality is necessary if medical schools are to give dentistry sympathetic cooperation.

So strongly is the Council opposed to a low-grade quality of predental education that this significant clause has been inserted in its minimum requirements:

> Preprofessional education given either by a dental faculty in a dental school or not mainly under the auspices of the academic college does not meet the minimum requirement in the sense in which the Council now

expects this standard to be enforced. After the close of the 1927-1928 academic year, a school conducting such a first year curriculum will not be eligible for a Class A or Class B rating.

That prospective students of dentistry may avoid embarrassment, adequate information pertaining to preprofessional collegiate education and the enforcement of that standard has been placed in the hands of the presidents of all American colleges and universities, members of all dental examining boards, and editors of dental and medical journals. These individuals have also received copies of the Council's Minimum Requirements for Class A Dental Schools and its latest classification of the dental schools in this country.

ADMISSION ON CONDITION

The admittance of students on condition is not in keeping with the highest standards in preprofessional education. The quality of preprofessional education should not be impaired in any way if undergraduate training is to be carried on under economic and efficient standards of teaching. The Council's "Minimum Requirement" permitting entrance on condition in one of the required subjects appears to be a relic of by-gone days and, in this age of progress through higher standards, should be eliminated.

The student of dentistry has his work cut out for him by an intensive schedule under the reconstructed curriculum. He has all the load that he can carry. If he begins with conditions, he cannot effectually use the principles involved in the earlier studies of his dental course. This tends to retard not only his own progress but also that of his fully qualified classmates.

I suggest that the following clause be incorporated in the Council's "Minimum Requirements": After the close of the 1928-1929 academic year, a school admitting a student with a condition shall not be eligible for a Class A or Class B rating.

TWO-THREE-GRADUATE AND TWO-FOUR PLANS

The present trend of dental education indicates clearly that in the near future the requirement of two years of collegiate training will be the standard. It was plainly shown in the Council's 1925 report that one year of such training is not a sufficient basis for the development of professional training. That a two year predental program will be the standard eventually is emphasized by the fact that thirteen schools now function on a two-year predental basis. Whether three or four years of undergraduate study are necessary for general practitioners to begin the practice of dentistry, with proper protection to the public, will be determined by the extent and quality of the test given the 2-3-graduate plan.

In comparing the relative merits of the 2-3 graduate and the 2-4 plans, one should have information relative to the extent to which the undergraduate courses have been well integrated in each, and know how intensively the courses are conducted and what each offers in the way of economy of time and effort; what advantages accrue to the student following the 2-4 plan, in return for the one additional year of his life spent in a dental school; what consideration each plan gives to the specialists of practice, and how the latter are to be developed under each plan. If no consideration is given to the development of the specialties of practice or of

true graduate work, how are teachers to be developed and research promoted?

MEDICODENTAL RELATIONSHIP

We should make a united effort to maintain and develop all the good features of the various types of education and training of a dentist, and, at all times, promote more broadly the medical outlook in the dental mind. Closer alliance between dentistry and medicine is the keynote of the progressive program of dental education. Without this quality of teaching and unity of outlook, a school's activities will be restricted, its growth will be retarded and its influences in offering the best type of health service education will be lessened.

Conscious of the necessity for wider development of the biologic phases of dentistry's procedures, and of an effective medicodental relationship, the Council incorporated in its "Minimum Requirements," under "General Comment," the following:

> The Council believes that a good working relationship with a hospital in the correlations between clinical dentistry and clinical medicine is a desirable feature for the training of the practice of dentistry. In the opinion of the Council, the public interest requires that dental and medical schools should effect the closest possible correlation in their related work. A university center for education in health service cannot be complete without a dental school.

It is the hope of the Council that all schools shall recognize fully the significance of these three sentences and direct their efforts tirelessly toward wider development and ever-increasing effectiveness in these important associations.

CLASSIFICATION OF DENTAL SCHOOLS

In the classification of the dental schools in this country, the Council has eliminated the designation "Class C," substituting the term "Unclassified."

Cincinnati College of Dental Surgery and Texas Dental College, which were rated "Class C" in all former classifications, are now "Unclassified" schools. The University of California School of Dentistry is in the "Unclassified" group, since it does not meet the Council's requirement of at least one year of collegiate preprofessional education.

A school which, in the judgment of the Council, (1) cannot meet the requirements for a Class A or Class B rating without extensive improvement and complete reorganization; (2) which is conducted for profit to individuals or to a corporation, or (3) which does not meet any other minimum requirements that are regarded as essential for a certified school, is not acceptable and shall be designated as "Unclassified."

At a meeting of the Council held in New York, Dec. 4, 1926, Kansas City-Western Dental College was granted an A rating.

Recently, the Indiana University School of Dentistry, Indianapolis, and the College of Physicians and Surgeons of San Francisco, Calif., were promoted to Class A.

ELIMINATION OF THE SPECIFICATIONS OF REQUIRED HOURS OF INSTRUCTION

While the Council lists courses that should be included in a well organized dental curriculum, it does not specify the number of hours for each course, believing that such strict regulation is not now in harmony with a progressive program in dental education. It does not designate the year or years in which any subject is to be taught, nor does it

suggest the apportionment of the hours for any subject to didactic laboratory, technical or clinical work. But while it leaves these details to the judgment of the officers of the schools, it insists that the sequence of presentation of courses and subjects should be based on sound educational and pedagogic principles.

The Council disapproves of overloading the curriculum, since this often makes thorough and painstaking study on the part of the student impossible, for he has so much of his time occupied in "doing" that he has little time left to synthesize in his own mind the knowledge he has gained from his courses.

The Council recognizes that variation and initiative are essential to effective education and does not aim to fit all schools to exactly the same mold in every detail. It realizes also that the dental graduate should be prepared to begin with adequate safety the practice of dentistry, but that experience is essential for his proper development, and that this experience cannot be acquired in the three of four years devoted to education and training. It does not aim to graduate an expert at the beginning of his career, but rather to so equip him that he may grow through experience to the attainment of this standard of excellence.

DENTAL JOURNALISM

The Council directs the profession's attention to commercialism in journalism.

The dental journals are the most important agencies in continuing the professional education of the dentist, and their attitude and conduct should be an earnest concern of the Council. All of the channels of publicity in dentistry should be open to responsible expression of opinion and statement of fact without interference or perversion by any commercial or selfish interest. There are no influential trade journals in medicine or in other professions, but dentistry continues to approve such journals and to lean on them. Now, commercialism is as strongly entrenched in dental journalism as it was a few years ago in some of the dental schools. Has not the time come when this Council should interest itself actively in the advancement of dental journalism under strictly professional auspices? I suggest that the Council propose a conference of the promoters of the leading dental journals with a view to effecting (1) the union of some of them with THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION; (2) the publication of these, some possibly as separate journals, under the auspices of the American Dental Association, and (3) the control of all dental publications by agencies wholly professional in character.

COMMERCIALISM

One of the revelations following the recent study of dental education is the failure of those who are profiting by commercial tendencies to awaken to a realization that times, customs and conditions have changed as dentistry has advanced. Those who may be profiting from the educational, political and journalistic aspects of dentistry appear to be oblivious of the refinements of the new era. It does not seem to occur to them that, in dentistry's elevation from the vocational training basis to that of a profession under a cultural standard, certain changes have been in progress. As yet, these agencies have not felt the force of the altruistic movement, be-

cause attention has not been directed vigorously toward their discontinuance. If dentistry is to continue to grow and to attain the full stature of a learned profession, it must remove certain surviving influences and agencies obstructing its progress. May their exit from the dental educational program be speedy, for dental education is now solely a function of universities.

SCHOOLS FOR DENTAL MECHANICS

Chiefly for the information of foreign medical and dental licensing boards and boards of health and foreign embassies, the Council calls attention to the fraudulent practices of individuals masquerading as graduates of dental schools and holding "diplomas" from so-called schools of mechanical dentistry. Through lack of information, officials may accept the certificates offered them by these pseudodentists in lieu of a bona fide diploma from a reputable dental school. The only schools in this country granting diplomas in dentistry that are recognized by the dental examining boards of this country are presented in the Council's classification of the dental schools in the United States, copies of which will be sent on request. (Address The Dental Educational Council of America, 1108 Union Trust Building, Providence, Rhode Island.) The possessors of these "diplomas" are not graduates in dentistry: they are merely mechanics and in no sense qualified to practice dentistry. As a rule, they are poorly trained, and they are often incapable of doing well, if at all, the mechanical work that their trade calls for.

The Council directs the attention of the profession to the growing activities of ambitious proprietors of schools of mechanical dentistry who exact exorbitant fees for generally poor instruction given hard-working, misinformed young men. These evil influences should be eliminated forthwith, for, in some respects, their activities are analogous to the pernicious practices of the cults which medicine is now encountering. These schools should not be permitted to use the term "dentist," which has a very definite legal import, but should be obliged to use "technician" or "mechanic" instead, so that the activities of dental technicians or dental mechanics would not be confused with those of the qualified registered dental practitioner.

The necessity for the training of some mechanics in dental schools to secure greater mechanical skill and to increase the clinical service of the infirmaries is imperative. The Council and the schools should give earnest consideration to this growing need.

DENTAL EXAMINING BOARDS

In the Council's 1926 report, the relationship between the dental examining boards and the schools was set forth. Activities of the past year plainly indicate that better coordination and more active cooperation in the affairs of these two bodies are essential. At the present time, many of the state dental examinations are not in harmony with the highest ideals of practice. The effect of some of these examinations on prospective candidates is generally uninspiring. Many of them stress chiefly the importance of technical procedures. The judgment of the candidate in determining the nature of oral lesions and his ability to decide what should be

done in any given case is often minimized. The biologic view, and questions of diagnosis, as well as of prevention of disease, often receive only passing attention.

A model dental law formulated by the National Association of Dental Examiners should be a guiding and helpful influence in bringing about desirable improvements. The newly created National Dental Examining Board should be an important factor in developing the status and quality of our dental licensing examinations.

REDUCTION IN MEMBERSHIP OF THE COUNCIL

Advancing the Council's policy of economy in matters of finance as well as in other directions, without lessening its efficiency, the Council voted to decrease its total membership from eighteen to fifteen, limiting the number of representatives to five from each of the parent bodies.

CONSTITUTION AND BY-LAWS

In order to meet more adequately the requirements of continued progress, the Constitution and By-Laws of the Council, adopted in 1909, were discarded. A copy of the new Constitution and By-Laws is included in this report.

FUNDS FOR THE COUNCIL

Reference to past disappointments of the Council in its financial and other relationships with the Board of Trustees of the American Dental Association will serve no useful purpose at this moment.

We now have a Board of Trustees which fully understands the importance of the Council's position and problems, and we feel assured that funds to support adequately the activities of the Council will be forthcoming.

FULL-TIME SECRETARY

The time has arrived when the Council should secure the services of a full-time secretary, with an office developed along lines similar to those of the Council on Medical Education of the American Medical Association. Under the present arrangement, the Council's influence is restricted and progress is retarded.

ACCOUNTANT'S REPORT

September 21, 1927

Dr. Albert L. Midgley,
Union Trust Building,
Providence, Rhode Island.

Dear Sir:

Pursuant to your instructions I have examined the books of account of the Dental Educational Council of America, Dr. Albert L. Midgley, Treasurer, for the period August 1, 1926 to August 31, 1927, and present herewith a statement of cash receipts and disbursements for the period August 1, 1926-August 31, 1927. In addition to the expenditures recorded in this statement, bills amounting to $5,812.61 were sent to the American Dental Association for payment and were verified in detail by correspondence with Dr. Otto U. King, Secretary.

The cash balance of $108.04 was verified by a detailed examination of receipts and expenditures, and by reconciling the balance as shown by the books of account with a certificate of balance obtained from the depository. Cancelled vouchers supporting disbursements were examined and found to be correct.

There were notes payable on demand to the National Bank of Commerce signed by Dr. A. L. Midgley amounting to $1,700.00, which amount was verified by direct correspondence with the bank.

I hereby certify that the accompanying Statement of Receipts and Disbursements and the cash balance are correct as shown by examination of the books of account.

Respectfully submitted,

GEO M. REX,
Certified Public Accountant.

DENTAL EDUCATIONAL COUNCIL OF AMERICA

Statement of Cash Receipts and Disbursements

August 1, 1926-August 31, 1927

Balance, August 1, 1926		$ 208.54
Receipts		
From Demand Notes	1,700.00	
Bank Interest	.35	1,700.35
		$1,908.89
Disbursements		
Expense of inspection of Indiana School	278.78	
Expense of inspection of College of Physicians and Surgeons of San Francisco	417.79	
Expense to Detroit Meeting of Board of Trustees of American Dental Association	76.21	
Printing and Stationery	152.55	
Printing in connection with Carnegie Bulletin	109.18	
Office supplies and expense	38.10	
Stenographic services	79.00	
Telephone and telegraph	171.47	
Professional services	45.79	
Administrative expense	228.00	
Interest on notes payable	3.36	
Postage and express	86.83	
Bank service charge	1.00	
Paid to American Dental Association to close account December 16, 1926	112.79	1,800.85
Balance, August 31, 1927		$ 108.04

Audited and found correct, Oct. 25, 1927.

J. V. Conzett.
Alexander H. Reynolds.

STUDIES IN TRANSPLANTATION*

By DR. GEORG STEIN, Vienna, Austria

IN the dental literature of the last years, important biologic questions have been under discussion concerning the relation of tooth surface to the surrounding tissues—epithelium, connective tissue and bone.

ATTEMPTS AT IMPLANTATION

There is, for instance, one remarkable thing in scientific orthodontia that it is difficult to explain. Orthodontic measures affect the approach of the tooth to the alveolar bone, which exerts a pressure on the intermediate tissue. As result of this stimulus, the bone only is resorbed. The question is not yet answered (Gottlieb was the first to raise it) as to why this stimulus effects resorption only on the alveolar bone and not on the cementum surface, although the latter is also capable of being resorbed.

Another question of great biologic importance is included in the attempts to attain a reattachment of the connective tissue of the pocket to the surface of the tooth, if the pocket is deepened pathologically.

To the same group of questions belong also the attempts at tooth transplantation.

Attempts at transplantation, carried out systematically, seemed to be a suitable means of clearing up these questions.

To this end, I have been carrying out researches, during the last three years, in the Histologic Laboratory of the Dental Institute of the University of Vienna, which is under the direction of Dozent Dr. B. Gottlieb, and I shall here give you a short account of one part of my work.

In the first place, experiments were made in bone transplantation. This was done as a preliminary piece of research which should pave the way to more systematic investigation. Such transplantation experiments have been repeatedly undertaken on a large scale on the surgical side and there exist particularly the very thorough investigations in this field by Ollier Barth and Axhausen. Surgeons have sought principally to achieve in the shortest time the most complete substitution possible for some bone defect. In my researches, on the other hand, my aim has been not only this, but also to study more closely the manner in which living tissue reacts with the piece of bone grafted on it.

The experiments were carried out on rats, in the following manner: Femurs dissected in a sterile manner from a freshly killed rat were split longitudinally. Some of the pieces were freshly implanted, while others were treated (1)

*From the Histologic Laboratory of the Dental Institute of the University of Vienna.

*Read before the Section on Exodontia, Anesthesia and Roentgenology at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

with physiologic sodium chlorid solution; (2) with Pregl's solution (a physiologic solution of iodin; (3) dry; (4) with distilled water; (5) with glycerine; (6) with hypertonic salt solution; (7) with 5 per cent nitric acid, decalcified

tailed publication. Eighty-two rats were operated on in this manner on both sides so that 164 preparations were available for studying the various problems involved. In order to preserve unity throughout these first researches,

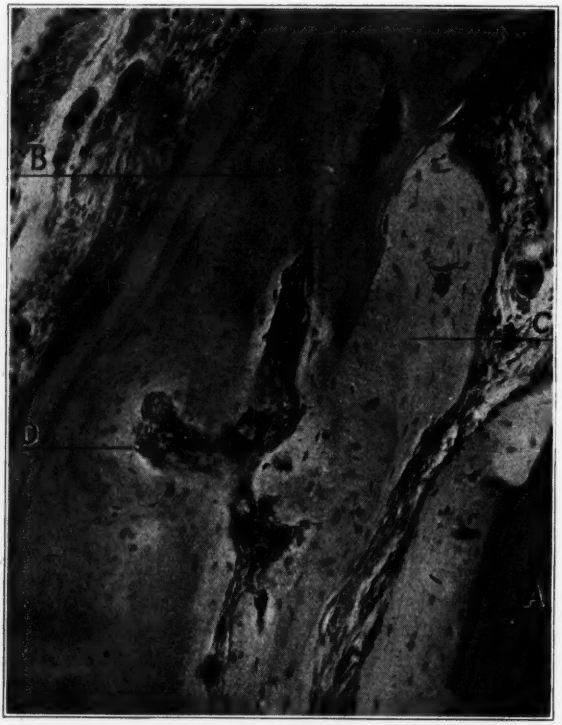


Fig. 1.—*a*, rat's femur; *b*, implanted piece of bone with empty bone cavities; *c*, deposition of newly formed bone on the surface of the graft; *d*, new formation of bone taking place around the marrow spaces of the implanted bone, which results in resorption.

pieces being preserved in (a) physiologic sodium chlorid solution and (b) Pregl's solution.

The pieces so treated were applied to the femur of a rat from which the periosteum had been removed. Details of the technic may be seen in the de-

all the animals were kept alive three months. In other researches now being undertaken, the length of life is being varied.

In experiments formerly carried out in collaboration with Dr. Kotanyi, it was shown that, with the exception of the

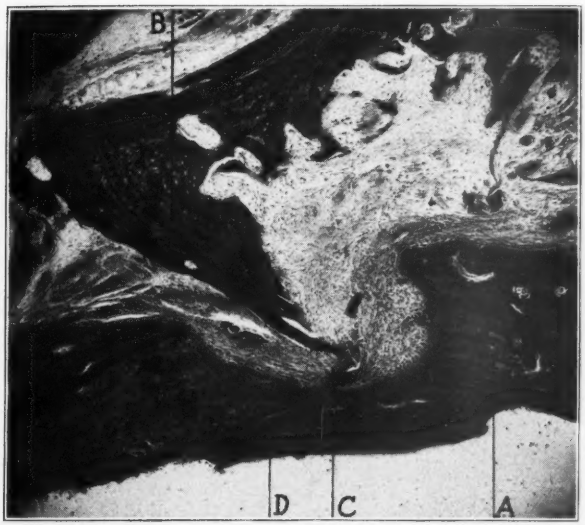


Fig. 2.—*a*, rat's femur; *b*, implanted piece of bone (no bony junction has taken place); *c*, resorption of almost the whole thickness of the femur; *d*, newly formed bone on the marrow surface of the femur.

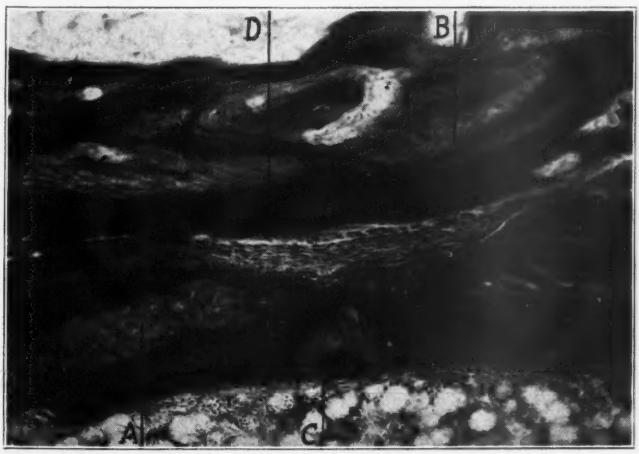


Fig. 3.—*a*, rat's femur; *b*, implanted piece of bone (no bony junction has taken place); *c*, extensive resorption of the femur with osteoclasts; *d*, area showing almost no resorption on the graft.

freshly implanted pieces, no distinct change in the effect of the inplantation was to be noticed; which depended on the time of preservation. All of us mentioned above are interested in the condition of the graft in its new environment. In this discussion, we will, for

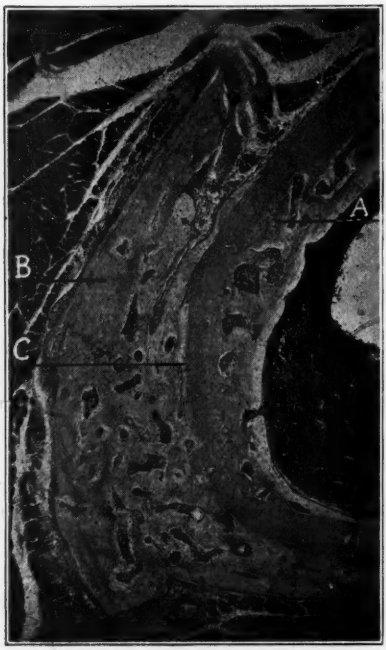


Fig. 4.—*a*, rat's femur; *b*, implanted piece of bone. Before bony junction had taken place, the femur was resorbed (*c*).

the moment, leave the decalcified pieces out of our consideration, as these showed in many respects special features. As regards the interesting conditions of the bone cells, I must also refer to the detailed publication for an exact description.

If the grafted piece lies at a distance from the femur in the soft tissues, when the healing processes are finished the connective tissue, which is poor in cells and blood vessels, closely invests the graft, and there are only very slight traces of a lacunar resorption on the graft. In no case could the deposition of new bone be observed on it when it was separated from the tissue proliferations arising from the periosteum and the marrow spaces of the femur. In the cases just mentioned, no difference could be established which depended on the manner of preservation. Perhaps the resorptions were a little more extended when the pieces implanted were quite fresh. So far, no histologic examinations have been made of freshly implanted pieces of bone that were covered by periosteum.

On the femur of the rat itself, active processes of absorption and construction take place, particularly at the place of fusion with the graft. The description of this would lead us too far from the subject. The important thing is the relation of femur to graft. The great majority of implantations resulted in the formation of a bony junction of graft and femur. When no fusion took place, this may be attributed to one of the following causes: (1) that the graft was separated from the femur by the interpolation of connective tissue or muscle or (2) that the manner of preparation or a slight infection arising after the operation had changed the latter's plantation qualities. It is to be seen that, with similar procedures, the majority of implantations resulted in fusion in whatever way the piece of bone was first preserved, with the exception only of distilled water. It is also to be seen that, apart from the pieces of bone employed when quite fresh, no noticeable difference could be found between the

different methods of preservation. In cases treated with distilled water, fusion failed to take place in the majority of cases. Even where a bony junction had resulted, we find the processes have gone no further than an early stage.

The fusion begins with the deposition of newly formed bone on the surface of the graft, and continues with the transformation of the latter in the way that has been described in detail by Barth and Axhausen. I cannot enter here into the exact manner in which the graft is transformed, nor into other questions of detail in this field. I can only emphasize the fact that it is not every kind of connective tissue that can effect a bony junction, but exclusively that tissue proliferation which arises from the periosteum or from the opened marrow spaces.

The observations to be made at the surface of contact between graft and femur demand more thorough discussion. If fusion has not set in, one finds, in quite rare cases, that no essential changes have taken place in the two surfaces that are separated by a thin layer of connective tissue. Much more frequently, we find, on the surface of the living femur, resorptions that occasionally reach such an extent that the whole thickness of the femur is involved. In such cases, only new formation of bone on the surface of the marrow space can prevent a perforation of the femur wall. On the surface of the graft, such resorptions do not often occur in the three months' duration of the researches. Where resorption does occur, it is insignificant in comparison with that in the living bone, as shown in Figure 3.

An exception are the grafts that are inserted when fresh. These may undergo rather extensive resorption. Also, when later junction between graft and

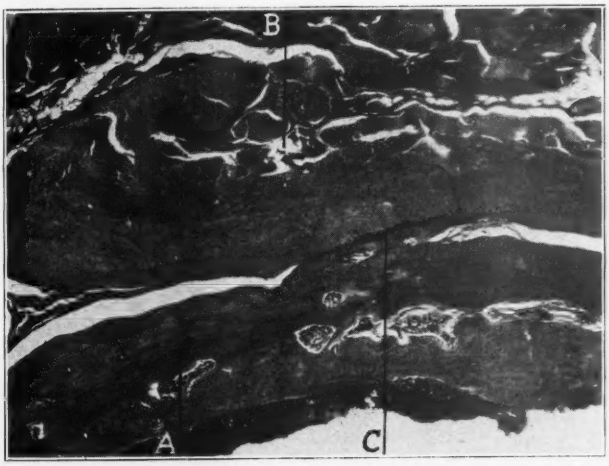


Fig. 5.—*a*, rat's femur; *b*, loosening of structure of the decalcified graft; *c*, place of junction.

femur takes place, resorption of the living bone usually occurs.

It must be particularly emphasized that, where the graft comes into contact with the femur and osteoblasts are active, the latter, though both sides are open to attack, act only in one direction. In the cases that we are considering, it is the living bone that is affected to a much greater degree than is the graft. The latter is composed too largely of resorbable material, capable of reaction with bone forming tissue, as possible later fusion shows; and as it is dead material, it could be expected that the organism would tend to do away with it. However, the living bone suffers more resorption than does the graft. Thus, it is doubtless some qualitative difference which leads the osteoclasts to prefer one of the two surfaces that are compressing the connective tissue lying between them. I place special stress on these observations because, as I shall show later, they possess a particular interest for us as dentists.

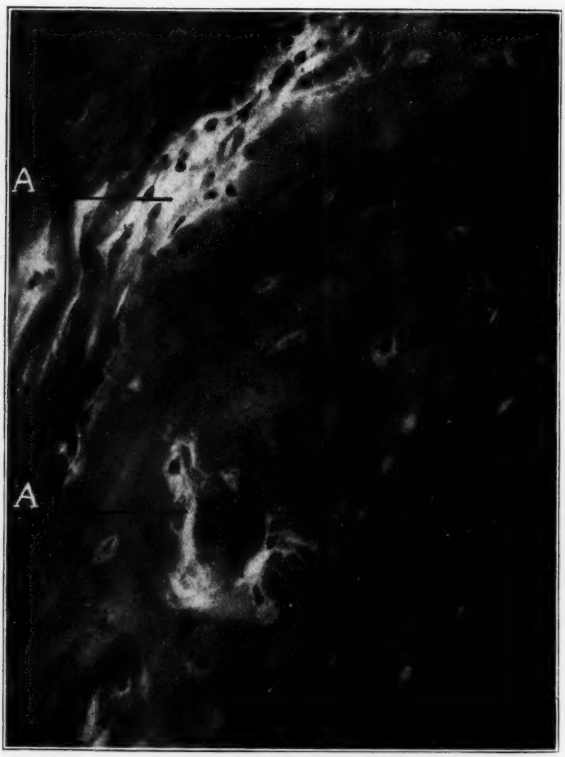


Fig. 6.—Decalcified piece of bone implanted for three months. Connective tissue penetrates into the finest cracks(*a*).

The experiments with decalcified grafts require special consideration. For definite reasons, the decalcification was effected in 5 per cent nitric acid with subsequent washing, without previous fixation of the graft and without subsequent treatment with sodium sulphate.

nuclei of the swollen bone cells are for the most part still faintly stained. I cannot here go more closely into the interesting observations regarding these bone cells, nor into the manner in which these decalcified pieces of bone are newly colonized by living cells.

Nearly all decalcified grafts succeed

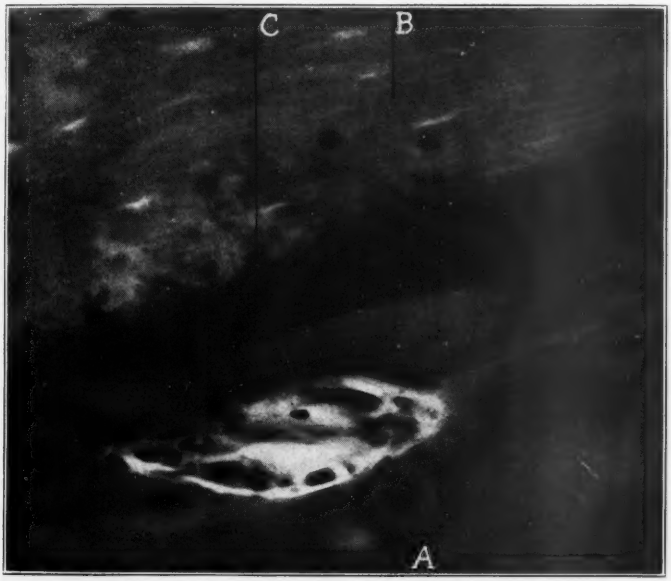


Fig. 7.—*a*, rat's femur; *b*, decalcified graft; *c*, recalcification at the place of junction in coarse globular form.

These decalcified pieces show, after transplantation, a considerable structural loosening. The connective tissue penetrates into even the finest cracks.

I must bring to your particular notice the fact that with no bone treated otherwise does the connective tissue come into so intimate a connection. The ground substance of the decalcified bone, which is swollen, is distinctly less deeply stained than the living bone, and the in making a bony junction with the femur of the rat; but the manner in which this junction takes place is essentially different from the condition in those cases in which the graft is not decalcified. Here, too, the first event is the deposition of newly-formed bone on the surface of the graft. In the places in which new bone is found deposited, there is to be seen, in almost

every case, a recalcification of the decalcified bone in coarse globular form.

In contrast to the absorption of the bone in other grafts, the lacunar resorption is restricted almost exclusively to the recalcified parts. It is only rarely that a resorption lacuna reaches into an unrecalcified region, as it does in Figure 8.

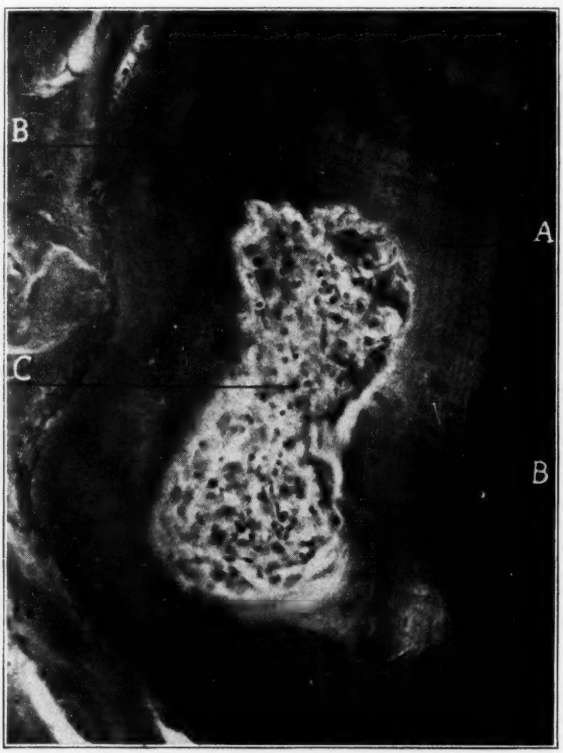


Fig. 8.—Part of a decalcified piece of bone implanted for three months. *a*, unrecalcified part; *b*, recalcified part; *c*, area of resorption partly extended into the unrecalcified part.

Osteoclasts are little disposed to act on uncalcified tissue. In this way, the decalcified piece is slowly transformed and replaced by living bone. If, at any place, decalcified bone, that is, soft, unresisting material, lies on the living bone without being fused with it, resorption results in the living bone, while the surface of the decalcified graft remains unaffected.

I must forego further discussion of the interesting process of recalcification, and of many other details besides.

SUMMARY

With all the methods by which I have treated grafts, fusion has followed at

least occasionally. Fusion takes place very quickly when fresh living material is employed. When physiologic sodium chlorid solution, Pregl's solution, glycerine, hypertonic solution or dry preservation is employed, fusion follows in about equal proportion. Distilled water constitutes a decided hindrance to fusion, while the use of decalcified pieces of bone is almost always followed by success. In the last case, a peculiar process of growing together and transformation takes place. The recalcification of the decalcified graft must be especially emphasized.

If no connection with the bone is effected, the graft may persist very long in the connective tissue in a nonreactive state, without extended resorption resulting. Deposition of newly formed bone only takes place when the graft comes in connection with the tissue arising from the periosteum or marrow spaces. Whether a bony junction follows or not, a greater or less degree of resorption of the living bone nearly always takes place where bone and graft meet. The graft that induces the resorption is not itself affected in anything like the same degree. The interpretation of these findings is difficult. Certainly, the assumption of mechanical-functional forces does not suffice to explain the matter. There are, in our experiments, surely some different qualities which induce the tissue to react in a different manner from its bony surrounding. From the mechanical-functional point of view alone, it is, for instance, difficult to explain also why newly formed bone proliferates into pieces of dead bone that lie by chance in the neighborhood of a living bone, and why, in this dead bone, resorption and deposition of new bone is induced. After complete transformation, the

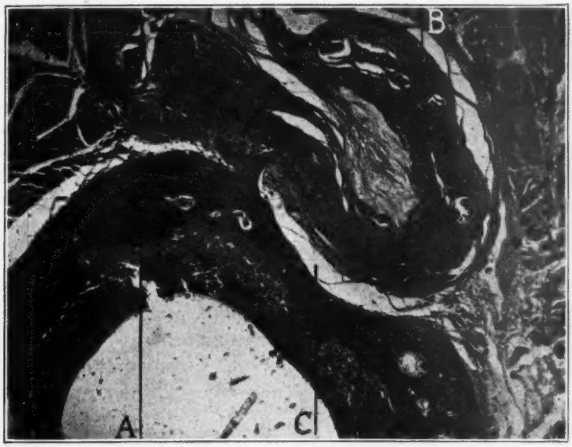


Fig. 9.—*a*, rat's femur; *b*, decalcified piece of implanted bone; *c*, resorption on the femur, no resorption on the graft, whose structure is loosened.

femur has, at this place, at any rate temporarily, an anatomic form that is not determined by muscular action or other stresses but by the accidental presence of a body into which bony tissue can penetrate. There are yet several

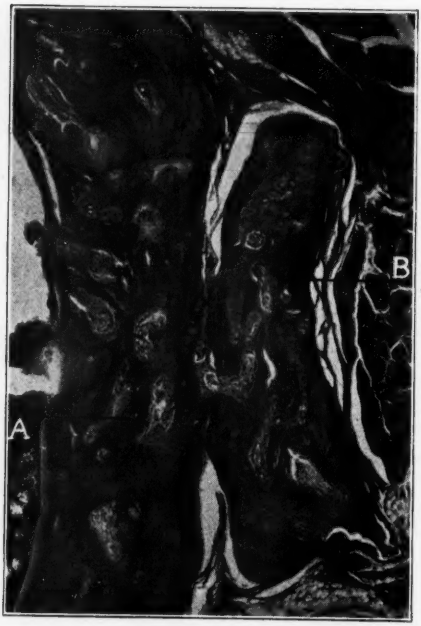


Fig. 10.—*a*, rat's femur; *b*, implanted piece of bone almost completely transformed.

other examples that we might cite to show this. It has again and again been asserted emphatically that mechanical-functional factors alone control resorption and regeneration of bone. I believe that my researches have shown that in order to explain some pictures of bone formation, other causes may also be assumed.

But my investigations are especially significant in regard to the following questions: 1. At the beginning of my paper, I mentioned some remarkable observations in orthodontia, having in mind the peculiarity that only alveolar bone is resorbed if the tooth is pressed against it by orthodontic measures. In our researches, we have seen an analogy to this. The grafts that fail to fuse with the bone exert a pressure on the bone that induces resorption on the femur, while they themselves are not greatly affected. There is certainly some qualitative difference that leads the osteoclasts to choose only one of the two tissues open to their attack. As the cementum alveolar-bone reaction closely resembles the graft-femur reaction, it would seem quite possible that cementum shows a similar relation to alveolar bone as the grafted pieces of bone to the living femur. But we cannot at all say yet what causes such similar effects under these different conditions.

2. The conditions we have reported are also of importance as regards systematic experiments in tooth transplantation, with which I have been occupied for a long time. These researches have not, however, advanced so far as to be ready for description. But I am prepared to announce that some favorable results have already been obtained.

3. The attempts to attain a reattachment of the connective tissue of the pathologic pocket might be undertaken now in a more systematic way.

Besides the theoretical importance of my experiments, the points just enumerated are the first practical conclusions of my investigations, which are now being carried on with the hope of further important results.

OPERATIVE PROCEDURES IN PERIODONTIA SURGICAL TREATMENT*

By JUSTIN D. TOWNER, D.D.S., Memphis, Tennessee

OF the three surgical operations employed in the treatment of periodontal lesions: curetment of the gingival crevice, or crevicular pocket with overlying tissue *in situ*, gingivectomy, and the flap operation; the first is considered conservative, the other two are known as radical. So much has been claimed for the merits of each that we now see the development of two groups, conservative and radical, within the ranks of periodontists.

Increasing discussion of cause and effect, as well as treatment and effect, is gratifying in that it serves to emphasize the prevalence of diseases of the periodontium and their disastrous sequelae, and intensify the effort to control these baneful conditions more definitely. Too much thought and operative effort cannot be directed toward the prevention and cure of such afflictions since they all tend toward the solution of a most intimate health problem. The pendulum of professional opinion has swung from one extreme to the other in respect to both etiology and treatment; from those who believe these lesions purely local and of mechanical origin, to those who consider these manifestations solely symptomatic of systemic debility; from those who do not believe in removal of deposits, to those who advocate either the resection or excision of gum and bone tissue. To one with extensive clinical experience in all types of cases and individuals, it is quite plain that the real truth lies somewhere between these extremes.

While it is not admissible here to consider the intricate physiologic structures, or the bacteriology and pathology of such lesions, the transmigration of the infection and its secondary effects, it is understood that a proper knowledge of these is necessary to appreciate fully the true significance of even incipient disease and determine proper remedial precedures. In addition to this, the surgical treatment of periodontal disease demands a thorough understanding of surgical principles, intelligent selection and use of instruments, persistent effort, and ability properly to instruct patients and secure their cooperation.

Unfortunately for both patient and operator, systemic conditions present an important problem to be considered in the treatment of diseases of investing tissues and means more for, or against, immunity than all else in certain cases. Were this not true, our efforts to control these local lesions would be more successful. The disposition to isolate this pathologic process and treat all cases independently of systemic conditions, yet recognize its detrimental in-

*Read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

fluence on physical resistance, seems illogical, to say the least. It must be admitted that our profession as a whole, whose business it is to control these lesions, has made a miserable failure of doing it. This cannot be attributed wholly to indifference or lack of operative ability. The answer seems to rest in the fact that we are not physicians with surgical instinct and reason. The crying need of dentistry today is the mouth physician and surgeon.

Too often, the integrity of the periodontium suffers more as the result of systemic debility than from local extraneous influences, and when the treatment is based upon a working knowledge of the histologic structures involved, the pathogenic organisms present, the true disease picture and the physical background on which recovery depends, radical surgery seems contraindicated as routine practice. The favorable results of radical operations are not by any means final, and, for this reason, thought should be given subsequent treatment. Personal experience and clinical observations emphasize the fact that regeneration of alveolar structure seldom, if ever, follows alveolectomy; in truth, the contraprocess usually obtains, in that a certain amount of resorption follows this heroic treatment. The question naturally arising, then, is: How many operations will these tissues tolerate before the teeth succumb for the want of support, if not to disease? True, resection or excision is often the most direct means of eliminating a pocket, or an extensive gingival crevice, and tends to promote more immediate recovery, but this is done at the expense of reattachment and possible regeneration, which must be depended on for most desirable results. It is fairly well agreed that detrimental exogenous influences should be eliminated, granulation and degenerated tissue removed, and exposed alveolar process and cementum curetted. The fact that this can be done in a manner to influence favorably nature's effort at reunion and regeneration is sufficient evidence to justify an attempt at conservation rather than deliberate destruction. It is noticeable that those who depend primarily on radical procedures fail to consider the endogenous factors entering into periodontoclasia and concentrate on the removal of exogenous influences and diseased tissue. If detrimental influences were purely local, susceptibility due only to malhygiene rather than inheritance, and resistance not so dependent on the mineral content of the blood, radical removal of all diseased structures as routine practice would be more tenable.

While the foregoing statements are true, it must be admitted that, in certain instances, radical surgery is indicted to the extent of gingival resection and slight curetment of infected alveolar process when it has become denuded by disease. Although I practiced and taught radical surgery as early as 1909, I have not employed or advocated it as general practice. Neither have I seen a mouth in which all periodontal disease suggested such treatment. In case of lower molar bifurcation involvement, which will permit the passage of a probe from buccal to lingual, gingival excision and bone curetment sufficiently extensive to permit proper cleaning will result in saving the tooth, provided its other supporting tissues have ample integrity. Likewise, the radical reduction of pockets mesiad to forwardly inclined molars, retromolar areas and wherever negative chemotaxis exists is indicated as good practice. With these facts in

mind, this discussion cannot be construed as an indictment of the radical operation *per se*, but rather considered a plea for more judgment in its use.

Essential to intelligent surgery in all pathologic conditions in the mouth is a comprehensive and thorough oral and physical examination upon which to base accurate diagnosis. No examination should be considered complete which does not include an inquiry into the case history and personal habits of the patient, as this is necessary to determine obscure etiology. That diagnosis which takes into account every evidence of cause and effect and assigns to each condition its true influence is a prime requisite to accurate prognosis and intelligent treatment. The physiologic and pathologic sense demanded in diagnosis is easily developed by all who appreciate its importance and come in close contact with health and disease.

In surgery, certain preliminary requisites are an essential part of any particular operation. In periodontal surgery, this preparatory procedure contemplates the prophylactic treatment of exposed tooth structures, beginning on the incisal or occlusal surfaces, provided the crown has sufficient integrity. The occlusion should be carefully noted and remedied if found to occasion stress in excess of that which the diseased periodontium will tolerate. In the case of excessive tooth movement during occlusion, as a result of inflamed or weakened supporting structures, stress relief will afford the rest necessary for recovery and will result in diminishing the depth of any pocket formation as occlusal contact is reestablished. This, including the polishing of the contact points, or noting them for correction as a postsurgical procedure is found abnormal; removal of exposed deposits of every nature; remedying ill-fitting crowns, bridges and faulty fillings; treatment of specific infection; gum massage; thorough polishing of all exposed tooth surfaces, and instruction of the patient in the use and care of the teeth, is most essential. Only by reducing the area and degree of infection and increasing tissue resistance can proper surgical approach be made. Whether this procedure on individual teeth is followed immediately by surgery, or the entire denture is so treated first, depends more on tissue tolerance in patients of low vitality than on the operator's preference. The essential advantages, of course, are the reduction of resident infection and the raising of tissue tone by lessening irritation and increasing circulation.

The immediate objects to be attained in this specialized surgery are the removal of all serumal deposits, the curetment of denuded and infected cementum and the removal of degenerated and necrotic periodontal fibers and alveolar process. To do this and leave the tissue in a condition favorable to recovery, reattachment and regeneration demands the most accurate and refined surgery known. The deeper the crevice, the more restricted its area as a rule, and the more difficult it is to remove every vestige of nonvital tissue, which always precedes deposits and, when left, acts as a constant focus. Failure to go beyond the last particle of deposit, which is never located at the bottom of a pocket, and thoroughly curet this area is responsible for the existence of many so-called incurables. We call the subsequent outbreak, "recurrent infection," when, in truth, it is only a continuation of the original disease. Care should be exercised not to denude the alveolar process deliberately

since experience teaches that it will recover and often regenerate more quickly without curetment, unless directly exposed to the products of decomposition, in which case there is some excuse for the flap operation. Dislodging deposits and smoothing the cemental surfaces is a procedure requiring care lest this thin layer be pitted or punctured, this leaving an invitation for continued disease and pulp infection. All areas of ulceration and squamous epithelium should be removed, not alone to hasten recovery but also to promote reattachment.

Epithelium should be permitted only in the normal gingival crevice, as it prevents reattachment in its effort to protect the soft tissues. These granulations, while resembling granulomatous tissue, are not so strongly organized and are more friable. The epithelial chains found within this degenerated mass spring more often from the periodontal membrane than from the columnar type found in the normal gingival crevice. Fortunately, this tissue is easily digested and usually disappears when the etiologic factors are removed. Its elimination by phagocytosis, autolysis or artificial means, and its replacement with healthy granulation, are absolutely essential. The clinical fact that this does occur is definite evidence against reduction of all vertical pockets to the horizontal type, as in radical surgery. The periodontal ligament is a specialized tissue which repairs itself and regenerates to a greater degree than is ordinarily supposed. It is this pronounced effort at rebuilding that is responsible for the actual laying down of new cementum in some cases. As a stimulus to regeneration after surgery, simple orthodontia may be employed to move teeth deliberately out of position and away from the deepest pockets. When this is accomplished, the appliance may be removed, whereupon the teeth will slowly resume their desired position without loss of renewed periodontium.

The local treatment of periodontal disease is largely instrumental and is applied chiefly to exposed and denuded tooth surfaces. In the removal of serumal deposits, dead periodontal fibers and necrosed cementum, the approach should be made with precise and delicate touch, which precludes unnecessary tissue injury. Even in the absence of undue laceration, infection is forced directly into the soft tissue as instrumentation proceeds, and, for this reason, a limited number of teeth should be treated at one time, the exact number depending on the severity of the disease and the tissue resistance and the tolerance of the patient. While introduction of these living organisms results in autovaccination and favorably influences substantial recovery, there is no reason why patients should be subjected to overdosage rather than the mild cumulative effect of small doses.

All instruments used in subgingival surgery should be delicate, sharp and sterile. Their blades should be thin enough to enter even a normal gingival crevice without undue extension of this important membrane; they should be sharp to facilitate the discriminate treatment of root surfaces with the least discomfort, and sterile to prevent the introduction of alien micro-organisms. A precaution with respect to sterility, subsequent to boiling, is to pass the blade end through disclosing solution, or mercury cyanid 1:1,000, before introducing it into the gingival crevice, for its germicidal effect on foreign organisms and protective influence

against residential infection. Small thin curets of suitable angles seem more fully to meet the requirements as they penetrate restricted areas with less injury than either the file or the so-called scaler. The working plane of the curet is always the end of the instrument, this giving it the additional advantage of push and pull motion.

The sensations which an instrument should convey when introduced into pockets are: (1) a cushion-like contact with the gingiva and remains of the periodontal ligament; (2) the gritty feeling when the working plane touches concretions; (3) the choppy sensation typical of pus-soaked cementum or denuded alveolar process; and (4) the velvety feeling indicative of the hard and smooth root surface and alveolar wall. Any attempt to go beyond this point will result in overtreatment.

In postsurgical care, only simple therapeusis which will exert a protective influence against acid-forming organisms, reduce extracellular activity and stimulate normal function is indicated. There is certainly no excuse for continued use of highly alcoholic and astringent washes, since such preparations are inhibitory of native expression and incline the patient to dependence on artificial agents rather than natural secretions. In case the pneumatic spray is employed in the application of therapeutic aids, it should be used prior to, or immediately after, surgery of each tooth in order not to disturb the blood clot when once formed and thus destroy tissue-building plasma. It is advisable, in many instances, to protect the clot with a wax or zinc-oxid dressing. Mechanical stimulation, such as brushing, taping and exercise of the teeth, designed to raise tissue tone and maintain hygiene, is most important. Just as maintenance of the clot is essential to tissue repair so is stimulation and cleanliness necessary to healthy periodontium. No less a requisite in after-care is the restoration of tooth contour, contact, stability and position, which contemplates necessary fillings, crowns, bridges, fixed splints and orthodontia.

Occlusion should be checked during subsequent prophylactic treatment for the reason that teeth are in continual eruption, and occlusion is constantly changing. This is especially true when the supporting structures are weakened by disease. When a mouth is once reclaimed, protective treatment should be given at such intervals as susceptibility and the patient's inability to perform properly the toilet of the mouth suggest.

1206 Exchange Bldg.

THE PRACTICAL SIMPLIFICATION OF FIXED APPLIANCES*

By JAMES DAVID McCOY, M.S., D.D.S., F.A.C.D., Los Angeles, California

IN the evolution of orthodontic mechanism, many changes have occurred during the past twenty years. These have been concerned with details involving the refinement, addition and perfection of parts rather than with principles, for the limitation of fundamental advancement has been and will ever be bounded by mechanical laws which have been understood for generations. The stimulus for progress has come chiefly through a higher conception of the demands of treatment and the necessity of fulfilling its requirements.

FIXED APPLIANCES DEFINED

In the field of fixed appliances, which may be briefly defined as those which are securely attached to the teeth and can be removed and adjusted only by the operator, much fruitful interest has been centered. Owing to their wide latitude of application and the fact that they may be operated either outside the dental arch or within it, they have proved indispensable to most operators. Especially is this true for active tooth movement or that period which is frequently referred to as "primary orthodontic treatment." After this period or during secondary treatment, or retention, as some designate it, other types of appliances are often utilized to advantage. These are not concerned in this discussion, and therefore will receive but brief mention.

In the classification of types of fixed appliances, we have (1) those operating labially and bucally to the teeth, which are variously designated as labial arch wires, alinement wires, labial bows, expansion arches, etc., and (2) those operating from within and called lingual arch wires, lingual wires, Mershon arch wires, etc. As the principles of operation of this last mentioned type will be presented by others, they will not be further discussed here except when they are advocated in combination with the first mentioned type.

THE PURPOSE OF APPLIANCES

In the design and construction of any appliance, the object to be gained is the establishment of a stable base from which force may be applied to individual teeth or groups of teeth so that they may be gently and effectually moved to desired positions and relations. In order that such movements shall stimulate rather than inhibit favorable growth changes, such applied force must be under constant control and be applied definitely and accurately.

In fulfilling such requirements, the question of secure fixation is paramount to safeguard accurate force control. In order that the stresses incident to mas-

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

tication as well as interference by non-cooperating patients may not dislodge them, a sufficient number of teeth should be banded in addition to primary anchorage units so that interruption to appliance action will be prevented.

and staying qualities of bands and arch wires and is not in keeping with modern practice. Suitable alloys of precious metal having strength even when used in delicate proportions are now available and constitute an out-

TABLE 1.—DIMENSIONS OF PARTS

Band material for molars	0.006 x 0.17
Band material for incisors and other teeth	0.004 x 0.14
Wire for labial arch wires (center portion)	0.030 in diameter
Arch wire threaded ends (round)	0.036 in diameter and 1 in length
Arch wire threaded ends (rectangular)	0.040 x 0.030—1 in length
Wire for lingual arch wires	0.036 in diameter
Wire for hooks, spurs, etc.	0.030; 0.026; in diameter
Wire for auxiliary springs	0.020 in diameter
Half round wire for molar attachments	0.064 x 0.032

	Inside Diameter	Outside	Length
Half round tubing for molar attachments	0.0645 x 0.0325	0.098	0.100
Tubing (round) for horizontal molar attachments	0.037	0.064	0.32
Tubing (rectangular) for horizontal molar attachments	0.041 x 0.031	0.078	0.32
Tubing (split or open) for horizontal attachments to anterior teeth	0.037	0.056	0.100

TABLE 2.—FORMULAS OF PARTS

	Au.	Pt.	Pd.	Ag. Cu. Alloy
Band material for molars	60	16	6	18
Band material for incisors and other teeth	60	16	6	18
Wire for labial arch wires (center portion)	64	13	0	23
Wire for threaded ends (round)	64	13	0	23
Wire for threaded ends (rectangular)	64	13	0	23
Wire for lingual arch wires	64	13	0	23
Wire for hooks, spurs, etc.	64	13	0	23
Wire for auxiliary springs	60	20	0	20
Half round wire for molar attachments	65	15	5	15
Tubing (round) for horizontal molar attachments	65	15	5	15
Tubing (rectangular) for horizontal molar attachments	65	15	5	15
Tubing (split or open) for horizontal attachments to anterior teeth	60	20	0	20

While the factor of simplicity is ever to be sought, it should not be carried to the extent of endangering efficiency.

SUITABLE METALS AND ALLOYS IMPORTANT

The practice of using flimsy non-precious metals for banding teeth has frequently endangered the efficiency

standing factor for appliance betterment. Through the cooperation of several manufacturers, these are obtainable in more or less definitely standardized form. As the same thing applies to other appliance parts, the operator may indulge his selection in accordance with his individual judgment. Round, half round, oval or rec-

tangular tubings and wire in any diameter and length desired as attachments to molar anchor bands or as springs and arch wires are available, which greatly simplifies appliance construction. Likewise, attachments for banded teeth to be moved are also obtainable, or the material essential to their making is produced in such form as to greatly lighten this task. Because of this, it is only necessary for the orthodontist to organize these facilities in order to render his routine operations effectual and pleasant.

As individual tastes differ as to the number, character and proportions of essential parts, in offering suggestions I do so realizing fully that others may obtain just as satisfactory results in using different means or by varying details of construction. In Table 1 are listed the dimensions of appliance parts as used by me, and in Table 2, the metals from which they are made is recorded.

THE PROBLEM OF MOLAR ANCHOR BANDS

As one of the first and most frequently dreaded tasks in starting treatment is the placement of molar anchor bands, any plan which will render it less difficult both for the operator and the patient should be listed as important and helpful. The use of seamless ferrules in graduated sizes of at least one hundredth part of an inch is one way of handling this problem. If these are made of a suitable alloy, they need not be wider than 0.17 inch or greater in thickness than 0.006 inch. If carried in a sufficient number of sizes, giving from seven to eight gradations, only the most extreme exceptions to tooth diameter will fail to be accurately fitted. These ferrules, when properly festooned and contoured, with the upper corners slit, overlapped and soldered, make very satisfactory bands. The same results can be obtained by

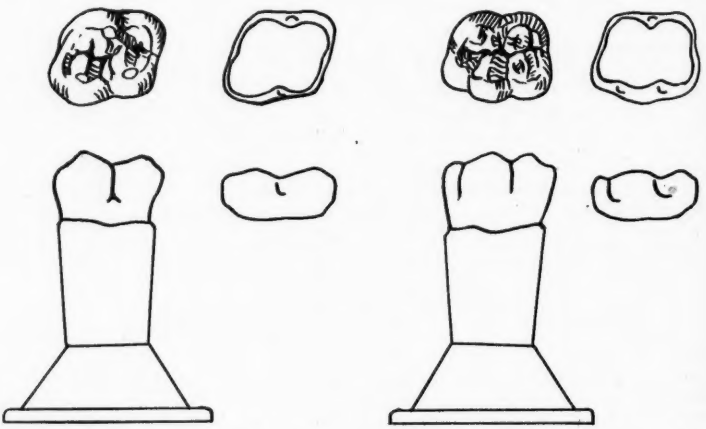


Fig. 1.—Typical metal models of upper and lower first permanent molars, showing occlusal and buccal aspects of models and bands constructed on them.

taking wire measurements of each molar tooth to be banded and cutting strips of band material to the required length and soldering them. This, of course, entails more time than the first method mentioned.

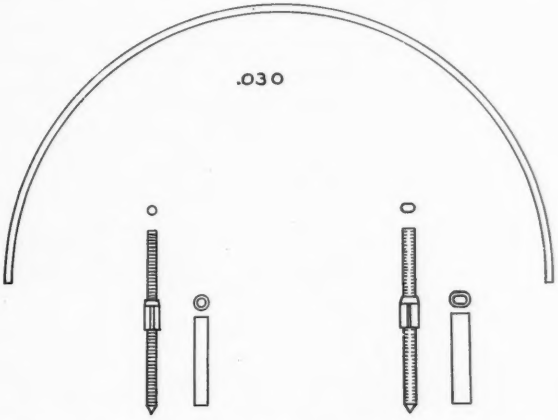


Fig. 2.—Essential parts for making labial arch wires, providing for either rigid or nonrigid anchorage.

METHOD OF MEETING THE PROBLEM

I have devised a system which, though its preparation requires a great deal of work, greatly simplifies molar band procedure, once the foundation is laid. Wax models of all four of the first permanent molars were carved up in as nearly typical form as possible. These were made in accurately graded sizes, eight models being made of each first permanent molar. In making the carvings, an attempt was made to re-

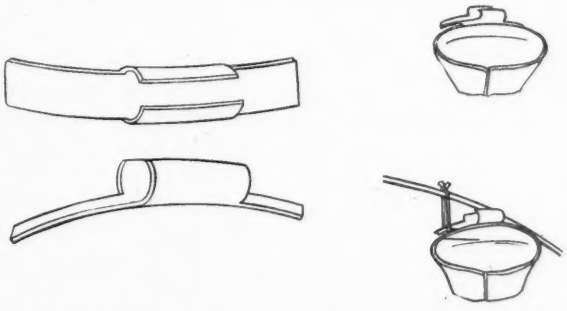


Fig. 3.—An "open tube" attachment stamped from a cross-shaped piece of metal. The two arms extending laterally from the "open tube" are not of equal length. Both serve to reinforce the band surface, and the end of the longer is left unsoldered when advisable and used as a "rotating arm."

produce the full contour of crown and cusp, as it was recognized, of course, that only an average could be realized owing to the natural variation found in different individuals. Each of these wax models was then invested, and the wax burned out and recast in a hard Melottes metal. These twenty-eight molar teeth, each having an ample base, were then mounted on suitable blocks, one for uppers and the other for lowers,

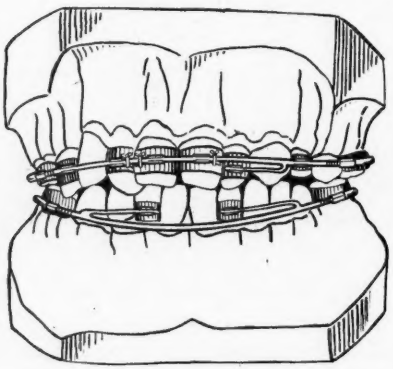


Fig. 4.—In the simple movement of one or more incisors, the direct force of the labial arch wire is not always essential, as auxiliary springs may be soldered to it at positions of advantage and the ends of these made to engage the attachments as shown on the lower lateral incisors and the upper left lateral incisor.

and bands were accurately fitted to each model tooth. This means that there is always available a stock of thirty-two molar bands, or eight for each first permanent molar, which range in diameter from the smallest to the largest teeth encountered. In adapting them to the teeth, it is only necessary to make very slight variations, Mershon contouring pliers being used for this purpose. In other words, the same result is obtained as when ferrules or the other bands are used except that it is made much more simple at the time of operation. In Figure 1, an upper and lower molar model is shown. As fast as the bands are used, the office technician replaces them, so that the stock is always kept complete. No attachments are soldered on the bands until they have been adapted to the teeth.

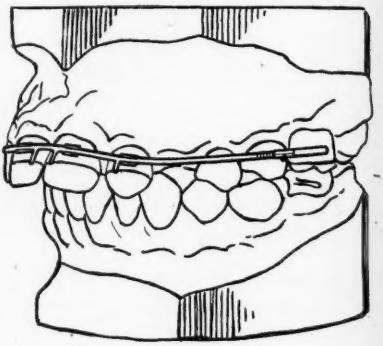


Fig. 5.—Vertical pins soldered to the arch wire to accomplish the bodily control of the incisor teeth.

ADVANTAGE OF STOCKING APPLIANCE PARTS

Other appliance parts may be standardized to the same degree. Labial arch wire parts with threaded ends, 1 inch in length, with suitable nuts, can be secured and kept in stock. These should be of universal size. Threaded round wire 0.036 inch in diameter has been found entirely satisfactory. With these should be provided close-fitting round tubings, which may vary in length in accordance with the operator's desires. Similar ends in approximately the same size made from oval or rec-

tangular wire with tubings to fit them should also be available so that, if the demands of anchorage require it, a rigid attachment may be realized. The working or central portion of the arch wire need not be so large as the ends engaging the anchor bands. Wire 0.030 inch is suggested. If used in suitable alloys, this is amply strong and has the advantage of greater resiliency than is to be found in the larger diameters. These parts are shown in Figure 2.

Objections are sometimes voiced in

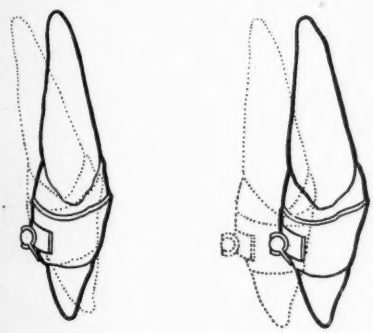


Fig. 6.—Character of changes accomplished through the addition of vertical pins.

regard to soldering the working portion to the threaded ends, the claim being made that in this process too much temper is lost. This factor may be controlled satisfactorily by using a suitable alloy.

ATTACHMENTS TO ANTERIOR TEETH

The question of methods of attachment to teeth to be moved other than the anchor teeth occupies an important place in appliance discussion. Some claim that rigid attachments are advisable, while others take the attitude that they should always be avoided. I believe that neither of these points of view are correct, as a thorough survey of the demands of treatment will reveal the fact that some teeth must be moved bodily while others must be tipped into position. Therefore, an attachment which has some degree of latitude should appeal to every thoughtful technician; in other words, we should be able to have a rigid, semirigid or nonrigid attachment according to the demands of the individual case. In fact, in some mouths and even on adjacent teeth, all three of these degrees of force control might of necessity be in effect. For this reason, the "open tube" attachment, when properly constructed and manipulated, will, in my opinion, more nearly fulfil the demands of an attachment than any other available. When machine made, from a suitable alloy, and used in conjunction with a labial arch wire, the working portion of which is 0.03 inch in diameter, any type of tooth movement may be accomplished with any degree of rigidity desired. This attachment, when machine made, is stamped from a cross-shaped piece of metal, so that two arms extend laterally from the open tube. (Fig. 3.) These serve to reinforce the labial surface of the band to which the attachment is soldered, so that, when the arch wire is unlocked, no distortion of the band surface is experienced. One of these little arms is made longer than the other, so that, when necessary, it may be utilized as a rotating arm in conjunction with some contractal form of ligature. This simple method of rotating teeth proves very efficient, and when the movement is complete, the rotating arm lies in contact with the arch wire. The open tube is then compressed a little more tightly about the wire and the rotation is retained. In

the simple labial movement of one or more incisors, the direct force of the labial arch wire is not always essential, for auxiliary springs may be soldered to it at positions of advantage, and the ends of these made to engage the attachment, as shown in Figure 4.

USE OF VERTICAL PINS IN CONTROLLING TOOTH MOVEMENT

Where the bodily control of incisors or other teeth is desired, the use of vertical pins soldered to the arch wire either just mesially or distally to the open tube attachment will accomplish the purpose. These pins should be made of fine wire, 0.020 inch being amply large. They need not extend beyond the edge of the band to which the attachment is soldered as sufficient leverage from short lengths will prove ample. By the addition of these pins, the vertical relationship of incisors or other teeth may be definitely controlled. In other words, a tooth under such influence may be moved bodily or the attachment may be used as a fulcrum and the root end moved labially or buccally and the incisal edge moved lingually. Figures 5 and 6 illustrate this principle.

Where this is to be accomplished, the vertical pin is given a slight bend toward the tooth before the arch wire is seated. In fact, it should come in contact with the tooth when the arch wire is just passing through the lips of the open tube. Great caution should be exercised in using this method as it is so positive that movement may easily be too rapid.

The bodily movement of teeth along an arch wire such as that necessitated where incisors are separated may be accomplished through the use of a silk ligature passed from the distal side of one attachment to the distal side of the attachment on the other tooth to be moved. These teeth will then slide along the wire (Figs. 7 and 8), their bodily movement being accomplished. When they have been brought to suitable approximation, short vertical pins may be soldered to the arch wire at points which will engage the distal side of each attachment and thereby hold the teeth together.

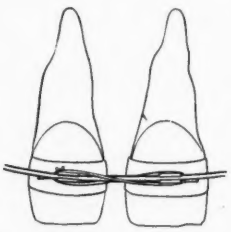


Fig. 7.—The bodily movement of teeth along the arch wire accomplished through the use of contractile silk ligature.

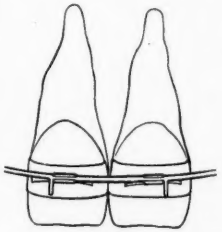


Fig. 8.—Short, vertical pins used to control central incisors which have previously been spaced and have been moved together.

UNLOCKING THE ARCH WIRE

When it becomes necessary it is easy to remove the arch wire from the attachments, through the use of a straight chisel having a long, sharp, beveled

edge, its blade being about 2 mm. in width. By placing the edge beneath the arch wire on the mesial or distal side of the open tubing and giving a sharp pry, the arch wire is unlocked. If a narrower chisel is used or one having a blunt edge, the operation is not accomplished with the same degree of ease. When the arch wire is to be unlocked at several points, it is best to start at one side and unlock it in sequence. The ease with which it can be removed and put back in place not only proves advantageous in making adjustments but is equally appreciated where breakage has occurred which necessitates appliance removal. When seated within the open tubes, the arch wire can be given any degree of rigidity of attachment which is desired by compressing the lips of the tubes against the wire with a pair of flat nosed pliers. This operation is easily accomplished but should be attended with care and carried out with delicacy of manipulation.

Some have condemned this appliance on the ground that the attachments were not possessed of sufficient holding power. This will depend entirely on how they are used and especially on the diameter of the wire used as the working portion of the arch wire. As stated before, the attachments are made to use with wire 0.030 inch in diameter. Anything larger even in a small degree, will materially reduce their holding power.

ESSENTIAL APPLIANCES

In an effort to work out a satisfactory and simple solution to the appliance problem, I have found that, in using the open tube appliance or the lingual arch wire on the upper teeth in accordance with the demands of treatment, very happy results may be obtained. On the lower teeth, except in those cases in which the lower arch is mesial to the normal, the lingual arch wire is used. These statements refer to primary orthodontic treatment only; for when this stage has been completed, other methods are almost always employed. In fact, during this period in all cases in which the patient's cooperation can be depended on, the Hawley appliance, worn at night only, is used to control the upper teeth. On the lower teeth, the lingual arch wire or some other form of fixed appliance such as the cuspid-to-cuspid retainer is utilized.

CONCLUSION

Practical simplification of fixed appliances is realized through the stocking of materials made from suitable precious metal alloys, consisting of (1) band material for molar teeth; (2) band material for anterior teeth; (3) round, half-round, oval or rectangular tubing and wire for anchor band attachments; (4) open tube attachments for the movement of anterior teeth; (5) threaded ends carrying adjusting nuts for making labial arch wires, these being in two forms, round and rectangular, so that the demands of anchorage may be met; (6) round wires in sizes 0.036, 0.030, 0.026 and 0.020 inch in diameter, which supply the necessary sizes for lingual arch wires, labial arch wires, auxiliary springs and such other attachments as prove advantageous and (7) seamless ferrules for molar bands or, better still, a stock of molar bands made in graduated sizes, as already described. With these supplies always available, appliances can be assembled quickly and the demands of treatment, as far as appliances are concerned, fully complied with.

The Journal of the American Dental Association

58 East Washington St., Chicago, Illinois.

C. N. JOHNSON, Editor

Published by the American Dental Association.

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising matters should be sent to the Advertising Department.

Subscription is included in the annual membership dues. To nonmembers living in the United States or its possessions, the price is $2.50 a year in advance; Canada, $3.00; Australia, $4.00; other countries, $3.25. All foreign subscriptions are to be paid in United States money.

Entered as second-class matter, March 22, 1915, at the post office at Huntington, Indiana, under the act of August 24, 1912. Published monthly.

Editorial

HOSPITALIZATION FOR DENTAL OPERATIONS

There is a growing tendency among certain of our specialists that should be discouraged before it goes any further. That is the habit of insisting that patients must go to a hospital for minor operations such as the extraction of a tooth. Not that every extraction is a minor operation, or that there are not exceptions to every rule; but to insist that a patient go to a hospital for the removal of a tooth—even a large majority of impacted third molars—is a waste of time, energy and money. It is a serious injustice to the patient, and smacks in too many cases of mere grandstand play. There seems to be an obsession on the part of too many in the profession to ape the spectacular. A hospital case is more impressive than an office one, but unfortunately the impression on the patient is not always a salutary one. To be sure there are certain individuals who like to be told that their case is unique, who gloat over the fact that they have some ailment of a character infinitely worse than that of any one else, and

to whom the prospect of going to a hospital lends a certain distinction. There is a temptation with that type to indulge in this grandstand play, but the proper and dignified procedure is to hew close to the line of fact with these people as with every one else and not humor any of their vagaries.

With most normal individuals, the idea of a hospital for the extraction of a tooth is more or less terrifying, and they should not be compelled to go there. All the surroundings of a hospital are strange and alien to the routine of their lives. It is bad enough to go to a private office, but this is a cozy home to them compared with the bare walls of a hospital. And it is only in the rarest cases that there is the slightest necessity for going to a hospital. The equipment in the average private office is superior in every way to that of a hospital for this kind of service, and the difference in the cost to the patient is somewhat disconcerting. This matter of cost should be considered by the professional man, but apparently the only consideration given it by some of them is to see how large they can make it.

No one wishes to detract from the great beneficence of hospitals. Without them, our civilization would not be complete, and for the management of certain diseases and for major operations, they are an essential part of medical and surgical service. But there is rapidly developing, both in medicine and in dentistry, what we may term a hospital habit. Patients are rushed to hospitals on the slightest provocation, and illness is made as expensive as possible. In too many cases, patients are ordered to a hospital more for the convenience of the professional man than for the greater welfare of the patient. That hospitalization is not necessary nearly to the extent to which it is practiced today is self-evident to any thinking man. Dr. Charles H. Mayo declares that "fully 90 per cent of all sickness does not require hospitalization."

If this can be said of ordinary illness, what shall we say of a case of tooth extraction? It is only in the rarest instances that hospitalization is indicated for this operation, and where it is done in any but these cases, it is more for the stage effect than it is for efficiency. Let our practitioners content themselves with

keeping their feet on the ground, and not soar off into the heights of theatrical pretense. In the long run, common-sense methods will stand the test and make a more permanent appeal than anything merely spectacular and flamboyant. Let hospitalization be reserved for its legitimate function and not be employed as a medium for impressing the patient.

"THE GOOD OLD TIMES"

Fortunately, we do not hear so much these days of the good old times. There has been altogether too much maudlin regret over the passing of these same old times. Let us be thankful that they are gone. Of course, there never was a day since civilization dawned that there was not some genius who saw farther than his fellows, who really got more out of life than his neighbors; but, in the good old days, men of this type appeared only once in a generation. The men who really thought, who were brave enough to unpinion their wings and take a mental flight out into the unknown, who dared to run counter to the prevailing opinion of the day, were few and far between. Now, the monarchs of thought are myriad in number. Every man realizes that he has the right to think for himself, and he also knows that his thought may take any form he wishes as long as it works no injury to his fellowman. Today, every man is a mental king and there are no serfs; every man may look the world in the face and think as freely as he fancies, and no ruler will clamp the manacles on him. Time was when men feared to express their thoughts lest they should chance to run counter to popular belief, or to offend the elect: now, there are no elect. The splendid courage of certain men has toppled the pedestal of pretence and brought down the pretenders. Now, all men are on a level; not mentally—that can never be—but in opportunity. Of course, in this emancipation, some men have thought wildly, foolishly, fatally. Emancipation of thought was never intended to lead to loose thinking, to wrong thinking or to lawlessness, but to that freedom of mind which gives full rein to the intellect.

What is the result of this mental emancipation? Progress such as the world has never known, and never dreamed of. Happiness such as had never before entered the hearts of men. The emancipation has been not only spiritual but also physical. Mental freedom has led to inventions that approach almost the miraculous. From utter darkness to the smoking fagot, the tallow dip, the kerosene lamp, and now a button is pressed and whole areas are illuminated, bright as day. From transportation on the naked backs of men, to oxen, to horses, and now we place a few gallons of liquid, which Nature has provided for us, in a tank and develop the power that transports us blithely over hill and dale at a pace never imagined in the times gone by. We travel farther with comfort over the country roads in a day than a horse could take us in a week, or an ox team in a month.

We have conquered the earth, and are fast conquering the air. We speak to each other across the continent or across the seas. We sit in a cozy home in the evening and listen to entrancing music played a thousand miles away. The air is made vibrant with melody, and we reach out with a wire and capture it. For the first time in history, we ascend so far above the earth that we look down at the clouds.

To be sure, there are some wrecks by the way, some lives lost, some griefs, some agony. A certain penalty is exacted for all this progress—we do not come suddenly or serenely into our heritage. We must grope a bit, we must blunder, we must stumble, and sometimes we must fall. But the splendid spirit of the age buoys us up, and we rise above our handicaps, we overcome our obstacles, we profit by our mistakes, we forget our agonies, and we go resolutely on to the achievement of new triumphs.

Compared with our present age, the good old times seem like a nightmare. There was so much misery, so much suffering, so much helpless deprivation. In the winter, it was a struggle to fight back the frost and keep it out of the home. Little children suffered miserably for lack of warmth, sometimes for lack

of proper food. They grew up with a hundred handicaps, some of which of course were good for them, but most of which retarded their best development. It was a fight to live, with no leeway to expand, and little incentive to excel.

The farmer, the cultivator of the soil, the man who provides the sustenance for all the earth lived a narrow lonely life. If sickness came, as come it did, he was almost hopeless. He could only lift his benumbed hands to heaven in a pathetic appeal for help. Physicians were scarce, and the means of getting to the bedside slow and uncertain. People died for lack of proper care. It was literally a struggle for existence, and the struggle too often fruitless. Children were clothed for grim necessity and not for beauty. No thought was given to adornment, and many a glorious little face and form was made hideous through incongruity of apparel. To get enough to eat and wear was the problem, without a thought of cultivating the finer graces of life—art, music, literature.

Go out in the country today and see the children on their way to school—clean, neat, beautifully and tastefully dressed—a perfect joy to the eye. There is more happiness in one school room today, more means of pure enjoyment than there was in a whole community in the days gone by. Children are coming into their proper heritage, and the generations of the future will be infinitely better than those of the past. Older people sometimes like to prate about the degeneracy of the day, and indulge in dire predictions as to the declining race. They see nothing but disaster ahead, and seem to assume that happiness is demoralizing—forgetting that happiness is humanity's greatest good. To be happy is man's manifest destiny, and the reason we have not achieved more happiness is because of the handicap of the good old times. There was not enough to go around. What little wealth there was in the world was in the hands of the few—the many groveled in poverty.

And think of the devastating diseases of the days gone by—when humanity sat benumbed and helpless in the face of the

sweeping plague! Think of smallpox and yellow fever; think of the terror in every household where there were little children when the dread maniac of diphtheria clutched the throats of helpless babes and strangled them to death before the eyes of agonized mothers and fathers!

The good old times!! We hear from the croakers that morality is waning, that licentiousness is running riot, that society is degenerating. They forget! Compared with the utter degradation, the bestiality and the blatant depravity of the past, the moral delinquency of today is stainless as the sunlight. It would not be possible for our common humanity today to sink to the level of some of the saints of the past.

The last refuge of the critic is that simplicity is gone, that life is too complex and that we are rushing aimlessly to confusion and destruction. Simplicity!—we all like that word, it is music in our ears, and we long to go back to the simple life. Let us see. Mayhap if we had it again, we would not find it so alluring. Simplicity is so nearly akin to ignorance that it is dangerous. The two have walked hand in hand on too many occasions, they have smirked at each other, they have sometimes married. Of all the handicaps of life, of all the calamities and disasters of human experience, ignorance stands out supreme. It has spread its pall upon the earth and has waved its withering blight over the hearts and minds of the sons and daughters of men. Ignorance is the great universal and colossal crime. Anything that dispels ignorance is good, anything that adds to it is bad. Since simplicity has always been so close to ignorance, let us not pine too much for simplicity. Let us pray only for light and truth, and let us follow where they lead. We may sometimes be dazzled by the brightness of today, but that is better than groping blindly in the darkness and ignorance of the good old days that are gone.

Instead of wasting lamentations over the depravity of the present, let us pick up the problem where we find it, and face the future without fear. We may rest in the assurance that it will never be so depressing as the past.

TRUMAN W. BROPHY, M.D., D.D.S., LL.D., Sc.D., F.A.C.S., F.A.C.D., O.I. (FRANCE)

(1848-1928)

Dr. Brophy died at Los Angeles, Calif., February 4, of bronchial pneumonia. The news of his passing will come as a distinct shock to his many friends in the profession everywhere. For more than half a century, he had been so intimately identified with the developments of the profession that his name was almost synonymous with the greatest advances made in that period. He was probably more widely known among the members of the dental profession than any other man, and in addition to this, he had an extensive acquaintance with medical men. He did a great deal to connect the interests of the two professions.

His death will leave a void in our ranks that will not soon be filled; in fact, dentistry in America will never be quite the same without the sustaining influence of Truman W. Brophy. His counsel in dental educational matters was always valuable and constructive, and most of the advances inaugurated in the past half a century were colored and formed by the beneficent influence of his virile personality.

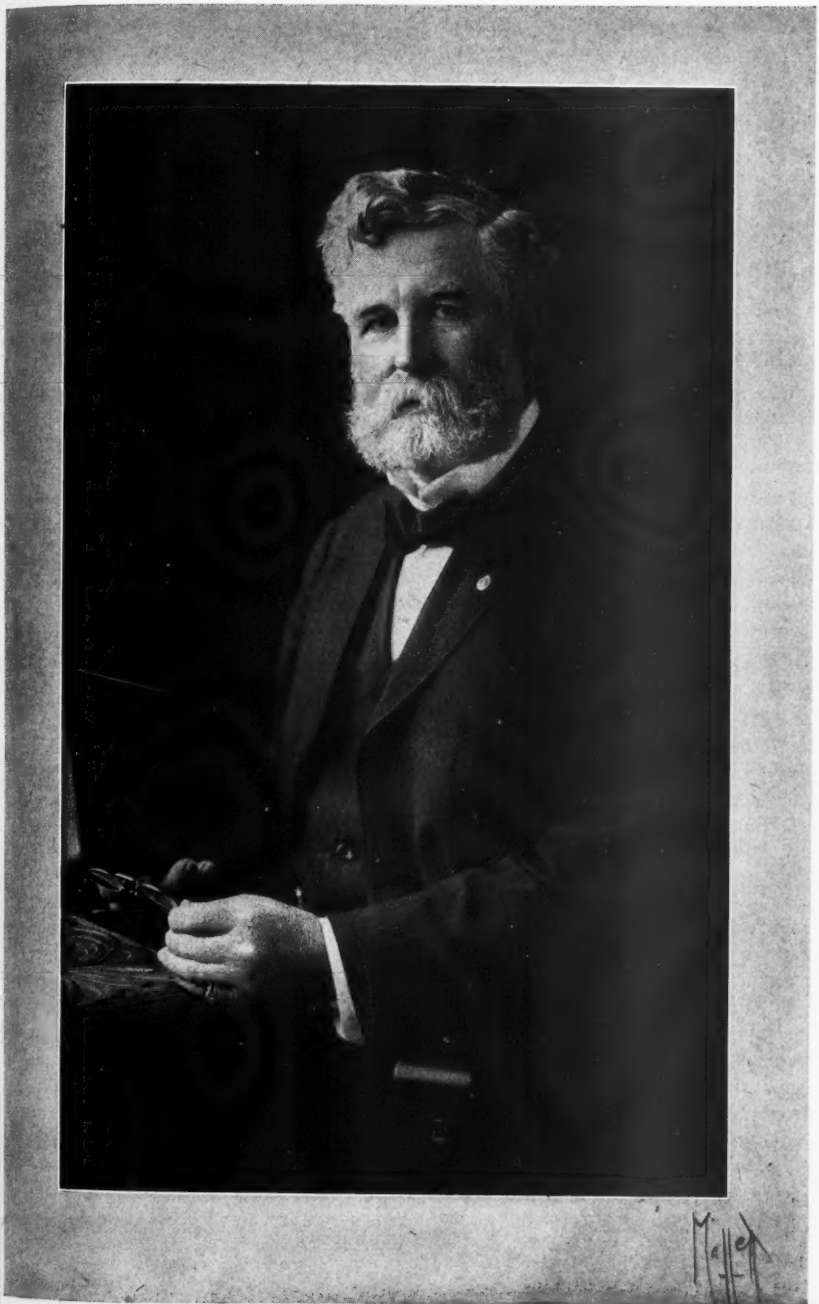
He is survived by his widow, Mrs. Esther Strawbridge Brophy, and four children, Mrs. Jean Mason Barnes of Redlands, Calif., and Mrs. Florence B. Logan, Mrs. Alberta L. Holloway, and Truman W. Brophy, Jr., of Chicago.

Dr. Brophy was born April 12, 1848, at Gooding's Grove, Will County, Ill., and was brought up on a farm. He attended "the old log school house" and from there, he went to the Elgin Academy. In 1866, he moved to Chicago and entered a dental office as apprentice. In 1872, he was graduated from the Pennsylvania College of Dental Surgery, with the degree of D.D.S., and in 1880, from Rush Medical College, with the M.D. degree. In 1881, he took the initiative in organizing the Chicago Dental Infirmary, which later became the Chicago College of Dental Surgery. He was the first dean of this institution and held the position till 1920, an uninterrupted service of nearly forty years in this responsible capacity.

In 1886, he performed his first operation for immediate closure of congenital cleft palate in a young infant before his class, and from that day, his name stands out as the premier operator in this department of surgery throughout the world. He had a record of more cleft palate operations than any other man living or dead, and the beneficence of his work has gone to the uttermost parts of the earth where children are deformed and mothers' hearts are sad.

There is probably nothing more majestic in all the annals of surgery than the single-handed fight put up by Dr. Brophy, in the face of the most strenuous opposition, in advocacy of his radical method of handling cleft palate cases in infants; and surely there is nothing more pleasing in contemplation than the ultimate results whereby he eventually won over some of his most noted opponents.

To make a bare mention of the various offices held by Dr. Brophy would be quite beyond the bounds of our present space, and we must content ourselves with a few of the most outstanding. He was a past president of the Chicago Dental Society, the Odontological Society of Chicago, the Illinois State Dental Society



TRUMAN W. BROPHY
(1848-1928)

and the National Association of Dental Faculties, and honorary president for the United States, of the Fourteenth International Medical Congress at Madrid. In 1914, he was made President of the International Dental Federation, a world organization, an office which he held till 1926.

Among his medals and decorations were the following: in 1902, a medal "Homenaje al Talento" from Prof. Dr. J. J. Rojo of Mexico City; in 1903, a medal for "Merited Distinction" from the Odontological Society of Paris, France; in 1906, the Fellowship Medal of the Dental Society of the State of New York; in 1913, the Medallion from the Italian Stomatological Society; also in 1913, a decoration from the French Republic, "Officer of Public Instruction"; in 1924, the International Miller Memorial Prize, from the Fédération Dentaire Internationale; and last, the crowning glory of all, the Decoration from the French Republic, of Officer of the Legion of Honor.

Such an array as this is most impressive, and yet it tells only in barest outline the professional history of this distinguished man. Of his personal history, there is even a brighter page. Dedicated to the relief of his suffering fellowman, he, at the very beginning of his career, stepped boldly out into the arena where theories are tested in the alembic of practical experience, and he was never compelled to recede from that first step. While much of his work was pioneer, he was always careful of his ground, and the result was that he became a world-wide authority on his chosen specialty. The sum total of what he achieved for his age and generation in the correction of one of the most conspicuous and distressing deformities of human kind can never be computed, but if the lisping tongues of babes could add their tribute to the chorus of hundreds of fathers and mothers throughout this and other lands, it would swell an anthem that would reach around the world. He who brings hope and happiness into a home clouded with despair; who, by the genius of his art, transforms a hideous wreck of humanity into a thing of grace and beauty; who makes the dumb to speak and the sad to smile; who waves his magic wand across the countenance of deformed and helpless childhood and works a miracle of regeneration,—this man is greater than potentate or prince; better than he who claims the plaudits of the crowd, or who marches triumphantly at the head of a legion of warriors. To save humanity is better than to achieve glory; to do good is better than to be renowned.

And in the quiet annals of the hearthstone and the home, where human hearts are mingled in the myriad lights and shades of hope and cheer, where the evening embers beam on the faces around the family fireside, and reflect the happy smiles of parents and little children—there the name of Truman W. Brophy will be spoken in heartfelt gratitude and loving memory long after many of the so-called great of earth have passed to oblivion and forgotten dust.

BUREAU OF DENTAL HEALTH EDUCATION

DIETETICS APPLIED TO ORAL HEALTH*

(Compiled by the American Academy of Periodontology, 1927)

ONE of the chief causes of disease of the teeth and their supporting tissues is faulty nutrition. Because this factor is so largely accountable for the loss of the teeth, and because of its being to so great an extent under the control of the homemakers, this bulletin is intended to be of aid and of interest chiefly to her. It is the homemaker's responsibility to provide meals for the family which will be health promoting, not alone to the masticating machine, but to the entire body as well, as far as facts are known concerning foods, and their nutritional value and correct preparation. To know there are vitamins A, B, C, D, E, and X, and important chemical elements in certain foodstuffs which are essential to our health, is of little use, unless this knowledge is applied in our daily choice of foods and their correct preparation for the table, and in the planning of meals.

Extensive investigation of the American dietary by scientific men has shown that it is often deficient in calcium, iron, phosphorus, iodin (in some localities), vitamins and roughage. It is an interesting fact that, in many foods, viz., cereal grains, potatoes, root vegetables, and most fruits, these elements are found associated with the outer structures, which, in the modern milling of cereal grains and usually in the preparation of fruits and vegetables for the table, are removed, wasted or destroyed. If these elements are missing, malnutrition ensues, and consequently diseases of various parts of the body, including the two dental diseases, dental caries (tooth decay) and periodontoclasia (commonly called pyorrhea), as well as irregular teeth.

To avoid malnutrition, we must carry our families safely beyond the line of danger by providing in the daily dietary plenty of clean fresh milk, fresh green leafy vegetables (raw and cooked), acid fruits, whole grain bread, butter, liver (at least once a week), and sea fish, at the same time reducing the amount of white flour, white sugar products (bread, cakes, candy, pastry) and muscle meats. Nevertheless, the mere quantity introduction of desirable articles in the diet will not be of much benefit unless care is taken in their preparation for eating. Many articles of diet of the utmost value to the body for the maintenance of health can be so handled in the kitchen as to be deprived of the greater portion of natural color, flavor and health-promoting contents. It has been shown that more than

*Bulletin No. 6. This is one of a series on the teeth and their care prepared for the information of the public.

half of the iron, calcium and phosphorus can easily be lost to the cooking water. It is of vital importance that homemakers give the various phases of this subject their time and study.

MARKETING AND SELECTION OF FOODS

In marketing for the family table, it is wise to select articles of food which are in their natural state, whenever this is possible. For example, if one can buy wheat in the grain, grind it (or at least purchase flour of the entire wheat), and with it make bread, a much more nutritious product is supplied the family than if the ordinary baker's bread is purchased. Food should be prepared in the home whenever practical rather than bought at the delicatessen or bakery. Purchase whole grain cereals, flour and bread, if the latter cannot be made in the home. It is essential that the foods selected contain roughage, such as is found in the whole grain cereals, fruits and vegetables. This roughage, or cellulose, is not assimilated, but is very important because it gives the teeth exercise, tends to keep them clean, to some extent massages the gums and is of great benefit in aiding and improving elimination. It also lessens the intake of concentrated food, which is often difficult to digest and assimilate. There are people who cannot use certain types of this roughage (such as bran, for instance), because of abnormal conditions of the intestinal tract. These cases are the exception and not the rule.

MARKET LIST OF FOODS CONTRIBUTING TO HEALTH IN THE MOUTH

The following food promotes health in the mouth:

1. Whole grain cereals: cracked wheat, barley, wild rice, brown rice, oatmeal, rye, cornmeal.
2. Prepared foods: shredded wheat, triscuit, ryekrisp, zwiebach, rusks, bran, grape-nuts.
3. Natural brown sugar, pure maple syrup, honey, raw sugar.
4. Certified milk (if clean raw milk cannot be purchased, the pasteurized should be used), cottage cheese, butter, buttermilk.
5. Lentils (easily digested and rich in mineral elements and roughage).
6. Sun-dried fruits and vegetables. Do not be deceived by attractive labels and names, but be sure that these articles are sun-dried.
7. Fresh, green leafy vegetables in season: lettuce (leaf lettuce is preferable), spinach, green onions, celery, asparagus, green string beans, swiss chard, endive, artichokes, dandelions, kale, okra, turnip tops, cabbage, savoy, brussels sprouts, broccoli, cauliflower, collards, water cress, leeks.
8. Root and yellow vegetables: carrots, beets, white turnips, yellow turnips, sweet potatoes, and Hubbard squash.
9. Glandular organs: sweetbreads and liver, especially.
10. Sea fish: halibut, cod, salmon, haddock, sole.
11. Ripe acid fruits: oranges, limes, lemons, grapefruits, peaches, plums, grapes, apples, blackberries, raspberries, cherries, nectarines, apricots, strawberries, pineapples, pears, tomatoes, tangerines.

12. Tubers: Irish potatoes.

13. For winter months, February and March especially: carrots, cod-liver oil, liver, eggs, spinach and acid fruits.

CORRECT PLANNING OF MEALS

It is the usual custom of the homemaker to select first the meat for a meal and then plan the remainder. This method encourages too much dependence on meat. A safer method is to think of meat as an appetizer, and in this way we will not be inclined to overemphasize it in menu building.

Ninety-nine per cent of the calcium of the body is in the bones and teeth. This mineral element is so necessary to life that if it is not supplied in the food, Nature removes it from the bones, and, it is believed, from the teeth also. Phosphorus, iron and certain vitamins are necessary in order that the body may use the calcium found in the food. These elements are of vital importance for the growth and maintenance of health in the hard structures of the body; hence, the framework of our meals should be made up of those foods which are the best source of these elements: milk, fresh, green leafy vegetables and ripe acid fruits. We may consider then adding the heat and energy producing foods, in the form of starches, sugars, fats and proteins. For example, dinner should include:

Calcium—Milk in a soup and as a beverage.

Phosphorus—Cauliflower—Ryekrisp.

Potassium—Potatoes.

Vitamins A, C, D—Lettuce with mayonnaise dressing.

Fats—Butter (vitamin A).

Appetizer—Protein—Iron—Liver and Bacon.

Sweet—Pears.

Roughage is supplied by cauliflower, potato skins, lettuce, pears and ryekrisp.

PRACTICAL HINTS

Do not serve two of the following starches at the same meal:

White potatoes, sweet potatoes; hominy, rice, spaghetti, macaroni, cake, white bread, white crackers, tapicoa, cereals, dried beans, peas or lentils, bananas.

Do not serve two of the following proteins as major dishes at the same meal:

Meats, nuts, cheese, legumes, eggs, fish, poultry, or sea food.

Serve two sea food dinners each week, for iodin.

Serve one meatless dinner each week. Chocolate, which is rich in fat, is a good adjunct to a meatless dinner.

Serve fruits at the end of a meal for the benefit of the teeth. Use them often for desserts instead of pastry, cake and puddings.

Use milk often in soups, creamed vegetables, sauces, beverages and desserts.

Serve something raw each meal to guarantee vitamins and roughage in the dietary.

The bleaching process results in loss of food value, so select green heads of cabbage, lettuce and celery.

Green lettuce has more vitamins than the white tender hearts.

Serve hygienic pies (deep dish fruits pies with whole wheat biscuit crust on top only), in place of the usual American pie.

Allow one quart of milk each day for growing children, and for adults in periods of "calcium stress" (lactation and pregnancy).

Use well ripened bananas only (with skins beginning to turn dark).

Excellent sources of the various food elements are:

1. Calcium: Milk, buttermilk, cheese, cabbage, cauliflower, chard, celery, egg yolks, oranges, string beans, turnips, turnip tops.

2. Phosphorus: Parsnips, peas (fresh and dried), peanuts, pecans, potatoes (white and sweet), peaches, pears, pineapple, plums, pumpkin, prunes, lentils, liver, lima and kidney beans, egg yolk, whole grain barley, rye and wheat, hazelnuts, almonds.

3. Iron: Liver, spinach, dried legumes, onions, egg yolk, molasses, dried sweet corn, prunes, dates, figs, almonds.

4. Vitamin A: Spinach, lettuce, carrots, cabbage, tomatoes, egg yolk, butter and yellow vegetables, cod-liver oil, liver.

5. Vitamin C (easily destroyed by heat or aging): Spinach, cabbage, yellow turnips, lettuce, tomatoes, potatoes, citrus fruits.

6. Vitamin D: Sunlight, cod-liver oil, fresh green leaves, acid fruits, coarse vegetables, onions, carrots.

Vegetables and fruit are as valuable in a diet as windows and doors in a house.

Mary Swartz Rose.

MENUS FOR ONE WEEK

Breakfast	Dinner	Lunch or Supper
Shredded wheat biscuit Sliced peaches and cream Zwiebach Butter Coffee Postum Milk	Cream of tomato soup Pot roast Raisins Beets, butter sauce Spinach Whole wheat rolls Butter Coffee Milk	Lima bean chowder Tuna fish salad Corn muffins Butter Applesauce Buttermilk
Parsley omelet Toasted corn muffins Butter Hot baked apples Milk Coffee	Tomato bouillon Baked sweetbreads Creamed peas Brown rice Celery Bread sticks Butter Grapes Chocolate Coffee	Baked pineapple Cottage cheese—Chives Nut bread Butter Baked bananas Milk
Cream of wheat with cream, Dates Bran muffins Butter Bacon Grapes Milk Coffee	Vegetable soup Salmon steak, parsley sauce Baked potatoes Corn bread Butter Peach salad, whipped cream Coffee Milk	Cheese fondu String bean salad French dressing Whole wheat bread Butter Blackberries and cream Buttermilk

Grapefruit Calves liver, bacon Toasted whole wheat bread Butter Buttermilk Coffee	Fruit (fresh) cocktail Roast chicken Brown sauce (parsley) Sweet potatoes, baked Steamed onions Whole wheat bread Butter Baked dates with cream Coffee	White soup Cooked vegetable salad Whole wheat bread Ryekrisp Cottage cheese Grape jelly Butter Cocoa
Poached eggs on toast Toast Butter Orange juice Prunes Milk Coffee	Cream of spinach soup Peppers stuffed with meat Baked potatoes Buttered beets Ryekrisp Butter Prune Betty Coffee	Cream brown rice with cheese Fresh green beans Grated carrot relish Corn bread Butter Grape jelly Chocolate
Oatmeal, raisins, cream Popovers, butter, honey Sliced unpeeled pears Cocoa Coffee	Watercress soup Broiled halibut, parsley sauce Carrot and cucumber salad French dressing Cornmeal dodgers, butter Milk Coffee	Liver, sweet pepper- onion sandwiches Grated beet relish Cherries, sunshine cake Milk Coffee
Banana mush, cream, almonds Melba toast Butter Sliced oranges Milk Coffee	Asparagus soup Boiled mutton, caper sauce Baked potatoes Baked onions Cabbage-celery salad Zwiebach Butter Apricots Coffee Milk	Cream of lentil soup Chicken salad sandwich Whole wheat muffins Butter Blackberries and cream Milk

Children should not be allowed tea or coffee. Adults should use these beverages in moderation.

CORRECT COOKERY

The object of cooking food is to improve its flavor, and to render it more digestible, but careless cooking extracts and wastes the flavor and frequently makes the food very indigestible. It also destroys the natural color of many vegetables, making them unattractive and less appealing to the appetite. There is a best way of cooking each article of food, and homemakers should be familiar with scientific cookery and the correct preparation of foods for the table in order that nutrients and roughage may be saved for the health of the family. It is of the greatest importance that we use our knowledge of the presence of vitamins in foodstuffs in our diet. Careless cooking may destroy the vitamins and waste or destroy mineral elements which are necessary for the maintenance of health and the preservation of the teeth.

SCIENTIFIC COOKERY SIMPLIFIED

1. *Preparation of Fruits for the Table.*—Wash carefully all fruits, fresh and dried, in cold water, and plunge quickly into and out of boiling water. Do not peel apples which have a thin skin, pears or grapes, if they are to be used raw in salads or in fruit cocktails. When peaches are to be peeled, press the surface of

the peach lightly with the back edge of the knife blade to loosen the thin skin, and remove the skin as you would that of tomatoes. If the fruit is to be cooked, it should be cooked the shortest possible time, and with the minimum of sugar.

2. *Preparation and Cooking of Vegetables.*—Since potatoes and root vegetables hold most of their mineral salts combined with the starch and cellulose directly beneath the skin, it can readily be understood that careless peeling of these vegetables is a mistake. Potatoes are rich in potassium, and potash salts are freely soluble in water; therefore, the usual method of peeling potatoes and allowing them to stand in water means the loss of these salts, of roughage and of masticating material as well. A good plan, when the jackets are not to be used, as in mashed or creamed potatoes, is to steam or boil the potatoes without peeling, and remove the skins while hot, and then proceed as usual. Because potatoes form so large a portion of the American diet, it is wise to prepare this vegetable correctly for eating. Young carrots and beets do not need to be peeled at all, and the older ones should be peeled after cooking. Use carrots, grated and raw, frequently. Onions can be baked in the skin, but if peeled, it is important to remove the least possible amount, as their salts are very valuable and easily lost. Beets can be grated unpeeled, then baked in a much shorter period of time than when boiled whole. Any method which shortens the cooking period for vegetables and fruits is an advantage, for it tends to preserve the nutrient qualities.

Vegetables that grow above the ground should be put on to cook in boiling, slightly salted water, in an uncovered kettle. Those that grow beneath the ground should be put into boiling, unsalted water, and cooked under cover. Do not peel vegetables for soups but cut in very small pieces. This will not be noticed by the family, and the nutrient qualities will be preserved.

Cooking of Protein Foods (Meats, Fish, Eggs, Cheese, Milk, Etc.).—Great care should be used in cooking these foods, since albumin is contained in them in large quantities. It coagulates below 180 degrees, and above that, toughens, as is easily shown by comparing the white of an egg which has been coddled for five minutes with one boiled three minutes, or a custard baked in a water bath in a slow oven with one baked in a hotter oven with no water as a protection. The latter is tough, indigestible and leathery, the former, very tender and easily digested. Cook all meats slowly, below the boiling point, but for a longer period. It is, of course, necessary to sear the outer surface of all meats very quickly at first, in order to retain the juice and flavor. Cheese is best when grated and mixed into potatoes, macaroni, noodles, etc., after they are removed from the fire. The heat in the food will melt the cheese, without toughening it. Milk used in cooking should never be boiled, and never be placed over direct heat. Always use a double boiler for cooking milk dishes. All cooking should be done before the milk is added, and then heated to the point of palatability, only. The vitamins in milk are easily destroyed by heat, and, for many people, overheated milk is difficult to digest.

Cooking of Starches.—The cooking of starches should be continued until the starch granules burst. This makes them more digestible. It is best to cook starches over the direct heat, when using flour or cornstarch for thickening gravies

and sauces. This is important. Cocoa contains starch and should be mixed with the sugar and a small amount of water, then put over the direct heat and boiled for five minutes, or until it thickens, before the milk is added, and then heated over a water bath. Sauces that taste pasty are not cooked long enough over direct heat to open the starch granules.

Heating of Fats.—Whenever possible, avoid overheating animal fats (butter, lard and suet), because this makes them indigestible. Melt butter over hot water and pour over vegetables in serving dish, if a butter dressing is desired.

Preservation of Vitamins and Mineral Salts in Cooking.—Do not peel vegetables or fruits, unless necessary, before cooking. If unavoidable, remove the thinnest peeling possible.

Save and use all water in which peeled foods are cooked.

Cook vegetables and fruits the shortest time possible.

Use a small amount of salt in cooking the vegetables that grow above the ground, and none when cooking those that grow below. Do not use soda in cooking green vegetables as it destroys the vitamins.

Do not let vegetables or fresh fruits stand in water for this lessens the nutrient qualities. This rule applies also to meats, poultry and fish.

COOKERY SUGGESTIONS AND RECIPES

Dried Fruits.—1. Wash and look over carefully raisins, figs, dates, prunes or any other dried fruit. Soak in water to cover for eight hours. Boil the water down in which fruit was soaked and pour over the fruit when it is cooked.

2. Steam fruit ten minutes. Use for breakfast or as a dessert with milk or cream.

3. Bake in a moderate oven for fifteen minutes, in buttered baking dish, adding enough of the water to cover the bottom of the dish.

4. Simply pour boiling water over the fruit in a sieve and serve.

Eggs.—1. Scrambled: For each egg use 1 tablespoonful cream. Place the cream in the top of the double boiler, add whole eggs and season, and when the white begins to set, draw spoon through yolks several times. Do not let the water boil in the lower part of the double boiler. Remove to a hot serving dish as soon as set. Serve with chopped parsley or on a bed of shredded leaf lettuce marinated in French dressing.

2. Coddled: Allow one quart of boiling water for the first egg and one extra cup for other eggs. Cover the pan and remove at once from the open fire to a warm place. Allow five minutes for soft coddled eggs and one hour for hard coddled eggs. If the eggs are taken directly from the icebox, they must first be dipped in warm water.

Soups.—A. *Chowders.* 1. Vegetable: Use any fresh vegetable, diced, preferably celery, corn, lima beans, turnips, cabbage or salsify, with onions and potatoes, diced. Cook the vegetables together, saving the water in which cooked. Add one pint or more of slightly warmed milk and one tablespoonful of butter. Serve at once so that milk will not be overheated.

2. Legume: Use dried peas, beans or lentils, soaked overnight. Cook until

nearly done. Add onions and potatoes, and as soon as tender, add milk and butter, as above.

3. Fish chowders: These, when made from fresh sea fish, are very wholesome.

B. Vegetable. 1. Use any fresh vegetables except beets and potatoes, with leeks, onions, chives, celery or parsley, cooked together, in the smallest amount of time, putting on to cook first those requiring a longer time, then adding others. Do not scrape the carrots, but cut very small. Tomatoes make an excellent base for vegetable soup. Two bay leaves or four cloves change the flavor. Two tablespoonfuls butter is added after the vegetable is taken from the stove.

2. For white vegetable soup, use any white vegetables, including onions and potatoes. Add warm milk, 1 pint, and 1 tablespoonful of butter. Serve at once. Do not overheat milk.

3. With meat stock, cook any combination of vegetables in the stock, only until tender, and serve at once.

4. Creamed vegetable soups can be made from cooked potatoes, lettuce, cauliflower, corn, tomatoes (add pinch of soda), watercress, salsify, celery, lima and green string beans, peas, spinach, leeks or grated carrots, mashed and with cooking water added to a thin white sauce; also by adding a little pure cream to the water in which vegetables have been cooked.

Recipes

Vegetable soup stock

1 cup of split green peas (unsoaked), 2 kohlrabi or turnips grated, 6 carrots grated, ½ ripe sweet pepper, 6 stalks celery (tops if desired), cut fine, 1 onion, 2 leeks, or chives to taste, 4 tomatoes, 6 sprays parsley.

Cook slowly for forty-five minutes. Strain, clarify and use instead of meat stock as a basis for soups. Do not cook again, but simply reheat when wanted, adding chopped shredded leaf lettuce, grated onion, or water-cress, cut fine, and 1 teaspoonful of butter.

Pot roast with raisins

Add 1 cup of raisins to a pot roast of beef at the beginning of cooking and continue as usual.

Liver baked with onions

Scald uncut calves liver, and place in buttered roaster on top of six slices of bacon. Dredge with flour. Cover with eight onions sliced and bake one and one-half hours. Serve with baked potatoes.

Boiled leg of mutton

Plunge into boiling salted water for five minutes, then add 1 cup of cold water or reduce the temperature to 180 degrees and cook for one and one-half times as long as is usual in boiling mutton. Albumin coagulates at 180 degrees, and the meat will be tender and of much better flavor than if boiled. Serve with caper sauce.

Lentil croquettes

Cook and mash 1 pint of lentils. Add ½ pint fresh mushrooms, simmered five minutes, bread crumbs, 1 cup, nut meats, 3 tablespoonfuls, and 1 beaten egg. Season with small amount of curry. Shape, roll in crumbs and brown in the oven.

Noodles

Flour, 1 quart, eggs, 4, salt, 1 teaspoonful. Mix well, divide into 4 parts and roll very thin, let dry for one hour, and spread on sheets of paper or cloth. Roll and cut fine.

Let dry before cooking. Use for soups and in place of macaroni, as they are more wholesome.

Noodle custard

Cook noodles, 1 cup, eggs, 2, beaten, salt, ½ teaspoonful, milk, 2 cups. Add milk to eggs and seasonings, then pour over noodles in buttered baking dish and bake very slowly until firm with dish surrounded by water. Just before serving, cover the top with dried grated cheese.

Cheese fondu

Grated cheese, ¼ pound, milk, 1 cup, soda, 1 pinch, butter, 2 tablespoonfuls, flour, 2 tablespoonfuls. Stir in double boiler until cheese melts. Eggs, 3, beaten. Add to the foregoing ingredients and stir. Bread crumbs, 1 cup grated. Bake in a slow oven until set, in a baking dish in hot water.

Corn pudding

Milk, 1 pint, eggs, 2, corn, 1 pint, salt, 1 teaspoonful, butter, 2 tablespoonfuls. Add to melted butter, milk and corn, eggs slightly beaten. Turn into a buttered baking dish and bake in a water bath in a very slow oven until firm.

Melba toast

Cut bread (white) very thin. Toast carefully and serve at once.

Peanut butter bread

Egg, 1, baking powder, 3 teaspoonfuls, molasses, 2 tablespoonfuls, peanut butter, 1 cup, entire wheat flour, 1 cup, milk, 1 cup, white flour, 2 cups, salt, 1 teaspoonful. Mix thoroughly. Let rise twenty minutes. Bake one hour in a moderate oven.

Cornmeal crisps

Scald seven-eighths cup of cornmeal with 1 cup of boiling water, stirring well. Add 1 teaspoonful of butter and one-half teaspoonful of salt. Spread on a greased inverted dripping pan and bake until well-browned. Serve in squares.

Banana mush

Bananas, 6, peeled and pressed through a ricer, 1 pinch of salt, ½ cup of boiling water. Cook over direct heat in the top part of a double boiler until boiling, then over boiling water until thick. Serve for breakfast with milk.

Prune Betty

Cover the bottom of a buttered baking dish with bread crumbs followed by alternate layers of prunes (cooked and stoned), dusting each layer with cinnamon and brown sugar. When the dish is two-thirds full, cover with hot milk and bake thirty minutes. Serve with whipped cream.

Orange dessert

2 oranges, juice and pulp, 1 lemon, grated rind and juice, 1 cup of sugar, 1 quart of water. Boil five minutes, strain, thicken with cornstarch and boil five minutes, stirring meanwhile, then add two egg yolks. After cooling, pour over sliced oranges.

Carrot relish

Grate fresh carrots. Add a few drops of onion juice and mix with mayonnaise. Serve with dinner in place of pickles, green olives, etc.

White sauce

1 pint of milk, 4 tablespoonfuls of butter, 4 tablespoonfuls of flour. Season to taste. Melt butter over direct heat in the top part of the double boiler. Add flour and cook, stirring constantly for two minutes. Then place a pan in a water bath and add milk gradually, stirring until thickened. This makes a medium sauce, which will not taste pasty, and the milk will not be overheated. Use as a basis for creamed soups and sauces.

Sandwiches

Use white bread for toasted sandwiches. Rye, graham, whole wheat, nut, currant, or peanut butter bread may be used to advantage for variety, in untoasted sandwiches.

Sandwich fillings

Hot apple sauce, brown sugar.

Cottage cheese with onion juice, parsley, chives or jelly.

Grated raw carrot, onion and mayonnaise.

Mashed, hard coddled egg yolk with lettuce and mayonnaise.

Sliced tomatoes with mayonnaise.

Mashed fresh berries or peaches (serve at once).

Cooked dried fruits chopped, mixed with orange juice.

Chopped dates and pecans.

Onions, chopped, and mayonnaise.

Egg yolks and sardines mashed. Mixed with few drops of lemon juice and melted butter or olive oil.

Often use raw onion, chopped celery or some green leafy vegetable in sandwiches.

Add chopped nut meats to jelly sandwiches.

Add grated cheese to hot white sauce.

Use hot liver and bacon, with toasted bread.

Chopped chives.

Sliced cooked sweetbreads, lettuce and mayonnaise.

Serve open faced sandwiches for a change, and salad sandwiches, with toasted bread.

Food Suggestions for Oral Health

Peaches, baked, steamed or stewed for dessert.

Parsley, cut fine and scattered over soups, potatoes or carrots.

Omelet, with asparagus or peas in white sauce; jelly omelet with vegetable dinner.

Prunes, cooked with orange or lemon peel or stick cinnamon. Use in breads and pudding.

Liver, made into a loaf with onion, parsley, sage, butter and breadcrumbs. Bake and serve hot or cold.

Eggs, coddled, shirred, scrambled or poached.

Oranges in salads and desserts.

Popovers, filled with fruits, as desserts.

Tomatoes, baked, stewed, escalloped; in soups, salads and stews.

Beets, grated and baked; stuffed and baked; also creamed.

Raw celery stuffed with cheese, peanut butter or mashed cooked liver and onion juice.

Leaf lettuce shredded and dropped into cream soup just as it is being served.

Cornmeal in mush; also cold mush sliced, dipped in egg and cracker crumbs and browned in a hot oven.

Fresh fruit cocktails. Dice several kinds of fruit, let stand one hour to blend flavors.

Sweet potatoes baked with sliced apples, small amount of butter and brown sugar.

Green bunch onions, boiled and creamed.

Asparagus, creamed with butter sauce, and in salads.

Carrots steamed; creamed; with butter sauce or as a substitute for pumpkin in pies and puddings.

Cabbage boiled or steamed with butter or cream, or raw in cold slaw or salad.

Lima beans baked with milk, a sliced onion and diced bacon.

Serve dates, raisins, figs and pecans together, and with milk.

Use chopped raw spinach, chives, grated carrots or onion over soups, salads or sandwiches.

Use milk frequently in soups and desserts.

Bake in hot oven, croquettes, potato and codfish cakes instead of frying them.

Do not pour milk or cream over ready-to-serve cereals until ready to eat them, since soaking makes them soft and they then require little mastication.

Serve fish and chicken salads in sandwiches for children. They enjoy other salads that way also.

Rich cake tempts one to rapid eating and overeating and encourages under-mastication; serve fresh fruits, dates or plain crisp cookies instead.

THE PREPARATION AND DELIVERY OF A SPEECH

By BERTRAM G. NELSON,* Chicago, Illinois

THE more people know about their teeth, the more they consult their dentist. The dentist who helps to educate the people in the preservation of their teeth not only serves his community, but also lays a foundation for a better practice, and a practice that is more satisfactory both to himself and to his patients. If every dentist in this country were an effective talker, and would spend one hour a month trying to get the people of his community to think straight about their teeth, it would be the biggest thing that has ever happened in dentistry. The greatest menace to teeth is not pyorrhea: it is ignorance, indifference, laziness, procrastination. Effective talk can greatly lessen this menace.

The dentist is the only man in the community in a position to carry on this educational program: he speaks with authority and he knows his subject—two important points in his favor. What he lacks is confidence in himself, experience in addressing audiences, and the technic of adjusting an idea to an audience. It is the purpose of this article to lead the reader through the steps of a process of preparation that will give him confidence, make up, as far as possible, for inexperience, and furnish a simple technic.

To make our problem definite, let us suppose that your phone rings, and a voice at the other end of the line says, "This is Doctor Blank, chairman of the 'Better Teeth Campaign.' The high school has given us ten minutes of their assembly period next Friday for a talk on the care of the teeth. The committee would like to have you give the talk." Being a dentist, you are, perhaps, unaccustomed to public speaking. Your first impulse is to decline. There flashes through your mind the painful picture of yourself as a youngster reciting a piece at the Sunday School Christmas party, after which you vowed "never again." You are not a speaker; you dislike trying to be one; moreover, you are busy. Think a moment. There are probably twenty-five boys and girls in that school who, in the course of ten years, will, under ordinary conditions, come to your office with teeth so far gone that all you can do is to extract or devitalize. The right word from you now, and some of those teeth might be saved. You are not being called on to deliver a speech but to render a service—a service which only a dentist can render. The situation not only offers an opportunity but also presents an obligation. You accept.

Being unaccustomed to speaking, your mind is probably in a whirl. You think of all the good advice you might give them; you flounder from one idea to another; you may work on one idea for hours, drop it and start on another; you sit at your desk and write, write, write,

*Professor of Public Speaking, University of Chicago.

although what you are writing may go into the waste basket later. Probably, the immediate result of your preparation is to work yourself into a state of nervousness, and a dread of the occasion. If you have a cavity to fill, you would not be nervous, excitedly picking up one instrument after another. You are master of the situation, and in mastery there is no nervousness. You are master because you know the technic; the steps that follow one another logically, naturally. So, too, in this matter of preparing a speech, there is a technic—logical, natural steps—and if you follow them, you arrive at the state of mastery—the only state in which it is possible to do good speaking.

The following list of steps is suggested, not with the purpose of preparing a subject, developing an idea; but rather with the purpose of preparing your mind, so that when you stand before the audience, you will be in a proper mental state to assume leadership and guide your listeners through the intricacies of thought, to your conclusion. Some of these steps seem so easy that you will be disposed to slight them. Bear in mind that every step suggested has been selected with the purpose of leading your mind through mastery of material to leadership.

STEP ONE: THE STUDY OF THE AUDIENCE

You naturally begin to think, "What shall I say to those boys and girls?" But your first step does not have to do with your subject matter; it has to do with your audience. What you say depends on your estimate of that audience. Bring them vividly before your mind. Ask yourself such questions as these:

1. Are they boys? Girls? A mixed group?
2. How old are they?
3. Have they any interest in teeth now?
4. Would a girl's interest in her teeth have the same basis as a boy's?
5. Have they had experience with dentists?
6. Do they like dentists?
7. What home training have they had in caring for their teeth?
8. Has the school taught them anything about their teeth?
9. How much can they receive in ten minutes?
10. What obstacles must be overcome?
11. Have they any prejudices that I need to overcome?
12. Has any other dentist been there before me? If so, did he make a good or bad impression?
13. What are the fundamental facts that have a practical application for them?

Try talking about his teeth to the next high school boy that you meet. Don't begin by giving him good advice but question him. Find out at first hand what boys of his age think about their teeth, and what care they give them. You will think this step is unnecessary and will try to remember what you thought and did at that age. Don't fool yourself. Talk directly to the present high school boy. Don't judge him by your own son or daughter. Your children were brought up in a home where toothbrushes were a religion. Talk to your boy's pal. Talk with several boys. After you have interviewed five or six boys and girls, notice how definite your image of that high school assembly has be-

come. Already you begin to feel somewhat at home with it. But a more important thing has happened to you: you are ready to take your next step in preparation.

STEP TWO: THE CHOICE OF THE SUBJECT

If you have actually taken the first step, the second will be easy; indeed, in some cases, the subject will be inevitable. If you try to choose your subject before studying your audience, you will get the same results that you would if you made an inlay before shaping the cavity—it won't fit. You are a specialist in orthodontia; you have a reputation in your community for straightening teeth: your temptation will be to talk your specialty to the young people. You wrote an article on this phase of dentistry, which was published, and which brought favorable comment: you will consider talking to them on that subject. You did some special research work while in college: it may occur to you to use that. If you have actually taken the first step, you will feel at once how absurd such a choice would be. Out of their need comes your subject. Perhaps you will choose some such topic as:

Teeth, Diet and Health.

Why and How to Use a Toothbrush.

How Decay Starts and How to Avoid It.

The Way of All Food.

The Tragedy of Neglected Teeth.[1]

STEP THREE: LIMITING THE SUBJECT

If you are not an experienced speaker, you will want to speak on all of the foregoing topics in one ten-minute speech, but the purpose of a speech is not to see how much ground you can cover, but how much you can get that audience to carry away and use. Good teachers say, "One idea to a lesson is enough." Advertising men say, "One idea to an advertisement is enough." One idea to a speech is enough—one idea explained, amplified, illustrated, driven home with stories of men and women who neglected their teeth in youth, and stories of men and women who took care of their teeth in youth. Your temptation will be to give them a two-year course in dentistry in ten minutes, but they are not capable of getting more than one idea in ten minutes.

Professor Baldwin says, "No man is ready to deliver a speech until he can put it all into one sentence." Test the clarity of your message in your mind by trying to put it all into one sentence. It may be an imperative, such as: "Care for your teeth regularly." "Build strong teeth; then guard them well." Or it may be a declarative sentence, such as: "The care of your teeth now may determine your future earning power." "Bill Jones' teeth kept him out of West Point." Such a sentence is not for the audience; it is for you to hold continually before your mind during your preparation to keep you from aimless struggling.

STEP FOUR: GATHERING MATERIALS FOR THE SPEECH

Now that you have clearly in mind your one idea, your first urge will be to look it up in scientific books or articles in THE JOURNAL. Don't do it. You have in your own head more facts than you can possibly use, and for illustration, go to men and women, not to books. You

1. At the close of this article will be found a list of suggested subjects.

want your speech to be alive and full of interest. You will kill it if you quote scientific facts out of books.

As soon as you have settled on the one idea of your message, begin talking it to everybody, not in terms of a speech but as a topic of conversation. If you say, "I am going to talk to the high school assembly next Friday on the subject, 'The Care of Teeth;' let me practice on you," you will get little for your efforts. Instead begin, "I had a peculiar case in the office the other day" etc., just "off-hand" conversation. Talk it eight or ten times with as many different people, watching the effect. Are they interested? Do they ask questions? Sometimes, your listener will come back at you with a better story than yours. Sometimes, he will take the opposite point of view. Listen when he talks: he may be giving you your best material.

While you are talking your idea to these different individuals, give your mind full freedom. If a new development of the thought flashes into your mind, try it; be venturesome. The fact that you have said it three times one way does not mean that you may not find a better way the next time. Some good phrases will stick to your mind and you will tend to use these repeatedly. Have a few cards on which you can jot good ideas, good illustrations and good phrases that occur to you. Do this, of course, after your listener has gone.

By the time you have reached your fifth victim, you will be surprised to see how freely and easily you talk. You have an abundance of illustrative matter; you have no embarrassment in speaking. In short, you have reached the stage of mastery of that idea, and no one speaks well on any subject until he reaches that stage.

In this step, you must solve the problem of "de-scientificizing" your idea. Being a scientist, you think and talk most easily in scientific terms. Your listeners are not scientific and your scientific terms mean nothing to them. Should you wish to refer to the gingiva, call them gums; instead of deciduous teeth, say baby teeth. Should you announce as your subject, "The Etiology of Dental Caries," not even the high school teachers would know what you meant, but should you announce as your subject, "Why Our Teeth Decay," the youngest high school pupil would understand you. It is difficult for you to grasp the ignorance of the lay mind as regards your scientific terms. To test this, ask some of the most intelligent people you meet—not doctors or nurses—the meaning of some of your most common terms. It will be a hardship for you to think and talk in these loose terms, but if your speech is to be a success, it must be done. This point cannot be overemphasized. Involved scientific explanations also should be avoided. If you were talking to your fellow dentists or to a class in dentistry, scientific terms and detailed explanations would be necessary; but you are to talk to high school pupils. As you try out these laboratory experiments in speech, give yourself practice in finding and using common words in place of scientific terms. If you cannot do it in private conversation, you cannot do it in a public address. This step of "de-scientificizing" your speech must be taken not only for this speech for the high school, but also for every speech you make, except those addressed to dentists, physicians and nurses.

If, as the good points come along, you have been jotting them down on

the cards, you probably have many times more material than you can use. That is a most favorable sign. But you must decide what you are to use and what you are to discard.

STEP FIVE: SELECTING THE MATERIAL

If you have actually gone over your material several times with different people, you have doubtless noticed that some of your ideas got across better than others; your own judgment told you that certain illustrations were better than others, one specific better than another. Pick from all your material only the best. Do not ignore the element of interest: not only must your speech be clear but it also must hold the attention, be interesting. Avoid the abstract. Tell your story by means of specific instances, illustrations that make pictures.

The use of diagrams and models adds greatly to the interest. It is easier to hold the attention through the eye than through any other sense. If you are good at sketching, draw the diagram of a big tooth (2 or 3 feet high) on the board, showing the location of nerves, and the way decay eats its way to the nerves. If you cannot sketch as you talk, a big tooth drawn on a large sheet of wrapping paper with colored crayons is good. One dentist made a large plaster tooth for this purpose. If you are to speak on the use of a toothbrush, be sure to use a large toothbrush and a large model. Abstract assertions do not take hold on the average mind; pictures do.

Avoid detailed scientific explanation and try to associate good teeth with health, future earning power, attractiveness, beauty, happiness; bad teeth with ill-health, inefficiency, bad breath, ugly looks, suffering, expense. These arguments are best made through the stories of people that you have known or heard about. Your years of practice have given you abundance of specific instances; use them. The positive rather than the negative; the health rather than the disease aspect should be presented.

STEP SIX: ORGANIZING THE MATERIAL

In a short talk, organizing the material may be nothing more than listing the points in the order you intend to use them. Again, certain facts must be introduced before you can arrive at your conclusions. Always give the reason or purpose before you give a direction. If you are trying to get the audience to do something, you must make them want to do it before you tell them what to do. If you can see natural lines of cleavage through your subject, this will furnish you the basis of subideas. There should not be more than three or four subideas in any speech. If you have more, you will discover that some of them are related and are really parts of a larger whole. Too many subideas are confusing to an audience. Your speech should be one important assertion, supported by two or three subheads, and these, in turn, amplified by one or two specifics.

STEP EIGHT: FORMULATING THE SPEECH

If you have followed directions, you have done very little writing; you have no manuscript. That is fortunate. Manuscripts frequently spoil good speaking. You have done a great amount of talking and some careful picking and choosing and outlining of material. In other words, your speech

is just where it should be, in your head and at the tip of your tongue, not on a piece of paper. There is nothing committed to memory, but having gone over your idea so many times, you cannot forget it. If you should forget one of your illustrations, some of the material discarded in Step 5 will rush in to take its place. Many good phrases have already become fixed in your mind, and much of the formulating has taken place while you were organizing.

It is well to have definitely in mind your opening sentence. The introduction is your first bid for the attention. It should be short, striking, even startling at times. The audience is thinking of as many different things as there are people in it. Your first sentence should catch the attention of every one there, and your second should direct the attention toward the subject matter of your speech. "Twenty-five years from now, not half the teeth now before me" (I am still imagining the high school audience) "will remain in the heads of their owners. If I could get my message over to you today, fifty per cent of those missing teeth could be saved."

The introduction should make the audience aware of the problem and center their attention on it; the speech should analyze and solve the problem.

STEP EIGHT: FIXING THE SPEECH IN MIND

With this method of preparation, the speech is already well in mind. If not, continue the talking process until it is. If you are fearful of mental lapses, carry a brief outline onto the platform. This should not be a logical, but a catch word outline of your facts, stories and illustrations in the order in which you intend to use them. The words "Jim Smith" on your outline might remind you of a story about Jim Smith in the narration of which you would inevitably come to one of the important points of your speech. A few such catch words would keep your mind moving in the right direction. Figures and quotations should be written into the outline and frankly read. Do not at any time try to conceal the fact that you have notes.

THE DELIVERY

Now comes the moment for you to step out before the audience. There is nothing to be nervous about, for you are not here to make a speech, but just to talk to these young people on a most important subject. You are not to use an oratorical tone, but your natural conversational tone, somewhat more animated. Your subject you have well in hand, for you have talked it over a dozen times, and you are just going over it the thirteenth time now. There is nothing alarming in the situation. Do not try to remember a lot of "dos" and "don'ts;" keep your mind off yourself and on your message. Instead of greeting the occasion as a terrifying experience, greet it as an opportunity.

VOICE

Talk out into the audience. It is a good plan to begin by talking to the people in the last row. If you are in the habit of talking in a low tone—your family know better than you whether or not you are—you had better practice a few minutes every day. Close the door and try to make someone in the next room hear. Don't shout; aim your voice through the door; put your body behind your voice and push it through the door; at the same time, think your idea through the door.

As you stand before your audience, you must be communicative. Do not think of your idea as existing in your head but be wholly absorbed in the process of making it exist in the minds of the audience.

PHYSICAL POSITIONS AND GESTURE

Stand in the clear, away from tables and desks. If you are near them, you will use them as a crutch. Stand with the weight evenly distributed on both feet, leaning slightly forward. The heels should be about 2 or 3 inches apart, the feet at an angle of about 45 degrees. Avoid too broad a base.

Do not worry about gestures: if you have an impulse to make them, do so, if not, leave them out. What gestures you do make should be full arm gestures, that is, made from the shoulder, not from the elbow, and should be made directly toward the audience, not to one side.

There are a multitude of "dos" and "don'ts" that might be recorded here, but it is best not to cumber the mind with them. The physical directions given above should be practiced in private until they become habit. One has no time on the platform to think of them. Keep your mind occupied with your audience and your message. Forget that you have hands and feet.

CONCLUSION

Books have been written on the preparation and delivery of speeches, especially on the latter. In this short article, an effort has been made to strip away all nonessentials and lead the reader through a short process of preparation that compels him to analyze his audience, master his material, marshal his vocabulary around his subject, and finally to bring him to the platform the natural leader for the moment, with a message and a communicative attitude toward his audience.

POSSIBLE AUDIENCES FOR GOOD TEETH PROPAGANDA

1. Schools
2. Parent-teacher associations
3. Women's clubs
4. Y. M. C. A. and Y. W. C. A.
5. Lodges
6. Moving picture theaters
7. Ladies' aid societies
8. Normal schools
9. Training schools for nurses
10. Boy Scouts
11. Camp Fire Girls
12. The grange
13. Civic clubs
14. Medical societies
15. County fair (A booth with lectures every hour by different dentists.)

SUGGESTED SUBJECTS

The Perfect 32.
Biting Facts.
It May Be Your Teeth.
The Gateway to Health.
When Teeth Go to School.
Better Teeth.
What Makes Our Teeth Decay?
Some Teeth Hints.
Building Strong Baby Teeth.
Caring for Teeth.
Your Priceless Pearls.
Teeth and Health.
Better Teeth for Little Children.
Eating for Teeth.
Your Teeth.
Toothfully Speaking.
Tooth Builders.
The Purposes of First Teeth.
Why Teeth Leave Home.
Home Care of the Mouth.
Uses and Abuses of the Toothbrush.

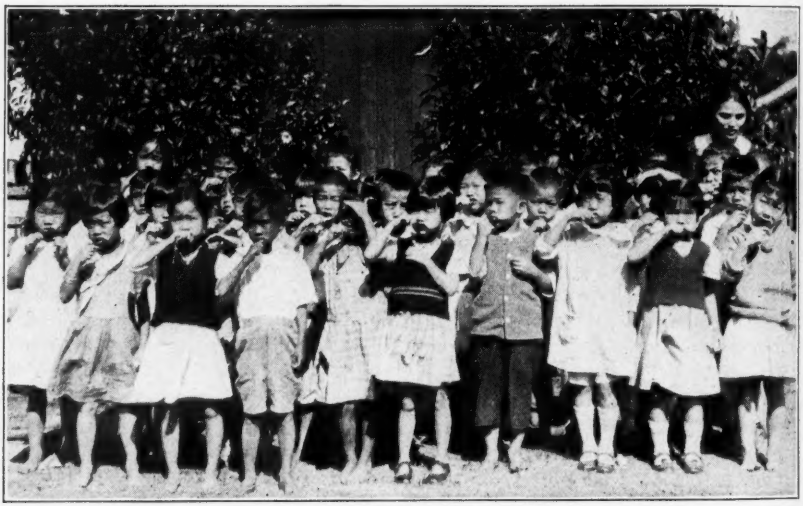
MOUTH HYGIENE IN HAWAII

By HELEN M. BAUKIN†

KAPEHU School is located on the Island of Hawaii, about 35 miles from Hilo. Last year, for the first time, Kapehu had the services of a dental hygienist, as living accommodations are rather difficult. It had heretofore been impossible to find a place for the hygienist to live, but last year, the principal of the school, with his family, moved to his home in the homesteads, giving his cottage over to the hygienist. His little daughter stayed with the hygienist during her three weeks' stay in the school.

The principal of the school is Chinese. He is especially interested in any health work in his school, and cooperated with the hygienist to the fullest extent.

A health book was made by the children of the school after the dental hygienist had left, and it is indeed interesting to read the letters they have written and to see how much they did learn in the short time the hygienist was on duty in their school.



Group of school children in Kapehu school, in toothbrush drill.

SAMPLE LETTER OF A FOURTH GRADE PUPIL

Kapehu School
May 6, 1926

MY DEAR SISTER:

I am going to write you a few lines about our teeth which I have learned in school today. There are two kinds of teeth. The

†Supervising Dental Hygienist, Department of Public Instruction, Territory of Hawaii.

first is called the baby teeth and the second is called the permanent teeth.

We must grind our food well. If we have a toothache we cannot chew our food well. If we don't brush our teeth every time our teeth will easily decay. And if we don't chew our food well we will have stomachache.

I did not know anything about teeth. Eating much vegetables and fruits is very good because it contains all the minerals. Our teeth needs the right kind of food. The teeth needs milk, vegetables, fresh fruits, and green vegetables.

We can easily keep toothache away by using a tooth brush after each meal and before going to bed. If we have a decayed tooth we must go to the dentist and have it filled. And if we don't go to the dentist the teeth will have a big hole. The germs will work very fast. We will not feel the pain or sickness right away, but later on we will suffer. We have to go to the dentist and have the teeth pulled out. We will not have our own teeth again. Laziness brings troubles.

We must use a clean toothbrush. We must not use other person's toothbrush. We must use our own brush. Do not use other person's toothbrush.

Your loving sister,

(Signed) DOROTHY AHYOA.

Health Habits (from Wahiawa School Oahu) Grade 4 A.

FIELD NOTES

In 1923, an examination of the teeth of the school children in 25 schools in Meridian, Miss. (most of them consolidated) showed that 85 per cent needed dental attention. In 1927, a reexamination showed that 70 per cent needed dental attention—an increase of 15 per cent in perfect mouths in four years. In the city schools, 72 per cent of the mouths are O.K. this year. Evidently, an effective program is being carried on with the dental hygienists, school teachers, superintendents of schools and local dentists cooperating.

Joplin, Missouri, has recently established a school dental clinic. For years, the local dentists have made annual examinations and the school nurses have carried on an intensive followup and education campaign. The program now is rounded out, all types of service being represented.

Medical and Dental News

California

Medical School to Be Consolidated: Following conferences between university authorities, the board of regents of the University of California has decided to bring all departments of the medical school together on Parnassus Heights, San Francisco. William W. Campbell, LL.D., president, says this means that those activities now conducted in departments on the Berkeley campus, such as pharmacology, biochemistry and bacteriology, will be transferred to San Francisco as rapidly as space on Parnassus Heights becomes available.—*J.A.M.A.*, Jan. 7, 1928.

Florida

West Coast Society Officers: At the recent meeting of the West Coast Dental Society, the following officers were elected for the ensuing year: president, C. C. Stewart, St. Petersburg; vice president, W. L. Northen, Sarasota; secretary, Fred M. York, St. Petersburg (reelected); treasurer, A. M. Smith, Tampa (reelected). The next meeting will be held in Sarasota.

Georgia

Sixth District Dental Society Convenes: Approximately 200 dentists attended the annual convention of the Sixth District Dental Society, in January, at Macon. Among the principal essayists were R. R. Byrnes of Atlanta, who spoke on "Cavity Preparation;" W. T. McFall, who gave two talks on ethics, and J. Russell Mitchell, of Atlanta, president of the state society, who gave a clinic on crown and bridge work, and presented the principal address at the banquet closing the meeting.

Illinois

Attendance at Midwinter Clinic: The annual Midwinter Clinic of the Chicago Dental Society was attended by more than 8,000, membership and visitor's badges to that number being exhausted on the second day of the meeting.

Massachusetts

General Hygiene for the Dental Student and Dentist: Realizing that the present course in dentistry makes heavy demands on the health of the student, and that the practice of dentistry as it is now conducted requires a healthy body as well as a healthy brain, the dean and the administrative board of the Harvard University Dental School have established a department of general hygiene to teach the students how to take care of themselves. This department is under the direction of Dr. Fred W. Morse, Jr., a graduate of Dartmouth College, and of the Harvard Medical School and the School of Public Health. Compulsory physical examinations of all entering students are now in force, and it is a requirement of the school that no man can graduate, receiving the degree of D.M.D., unless remediable physical defects have been taken care of. The weight of a student in doubtful physical condition is carefully watched, his living regime checked up, and advice given regarding the care of himself. As a part of the work of this department, cots with blankets have been placed on the roof for an outdoor rest period, where the students may get both rest and sunshine. Round table conferences are held where the student and instructor discuss health problems.—*Bull. Massachusetts State Dent. Soc.*, January, 1928.

Educational Program at Tufts Dental School: With the opening of the coming session, Tufts embarks upon a new and as yet incompletely charted educational program. The curriculum has been enriched by the addition of new courses; one in oral medicine which is given under the direction of a trained pathologist. The clinical resources of the City Hospital are available to him for teaching, and he expects to be able to show a

large number of oral lesions and to teach the dental student to recognize malignant disease in its early stages. With this training, the dentist will discover many unsuspected lesions and can warn the patient while the disease is still amenable to treatment. The school has also increased its service in children's dentistry by allotting to this important branch two afternoons a week in infirmary practice, having as patients preschool and first grade children exclusively. This is done in the belief that preventive measures are only effectual when evidence of potential disease is detected early in the life of the child. The teaching staff in this department has been enlarged and a closer study of the conditions which lead to dental disease will be initiated.—*Bull. Massachusetts State Dent. Soc.*, January, 1928.

North Carolina

Fifth District Society Meets: The Fifth District Dental Society, comprising thirty counties, held its annual meeting January 16. G. M. Cooper, of Raleigh, a member of the state board of health, spoke on "Pioneering in Oral Hygiene," and Malcolm G. Little, dean of the extension department of the University of North Carolina, spoke on "An Extension Course in Dentistry."

Rhode Island

State Society Elects Officers: At the annual meeting of the Rhode Island State Dental Society, held January 11-12, at Providence, the following were elected officers for the ensuing year: president, B. Cecil Burgess, Providence; vice president, Raymond W. Gatchell, Providence; secretary, Harry F. McKanna, West Warwick; treasurer, Thomas S. MacKnight, Newport.

Dr. Midgley on National Dental Board: Albert L. Midgley, secretary of the Rhode Island Board of Registration in Dentistry, has been appointed a member of the National Board of Dental Examiners.

Tennessee

State Society Officers: James B. Jones, Murfreesboro, is the newly elected president, and C. W. Hoffer, Nashville, the newly elected secretary of the Tennessee State Dental Association. The next meeting will be held in Nashville, May 8-11.

Texas

East Texas Society Organized: An organization to be known as the East Texas Dental Society was recently organized at Longview, with the following officers: president, W. H. Rickles, Marshall; vice president, S. W. Hagan, Tyler; secretary-treasurer, C. G. Kirkpatrick, Marshall. D. C. Johnson, Atlanta, C. D. McRimmon, Henderson, and A. L. DeWitt, Tyler, make up the board of directors.

General

Official Report on Causes of Death: The U. S. Department of Commerce announces that 1,285,927 deaths occurred in the registration area of the United States in 1926, representing a death rate of 12.2 per thousand of population, a slight increase over the rate for 1925. The principal increases in 1926 were from diseases of the heart, influenza, pneumonia, measles and whooping cough. The rate for heart disease increased from 186 to 199 per hundred thousand of population, which was the highest rate listed. The second highest rate, 102.5, for a specific disease was for pneumonia (all forms). The rate for cancer was 94.9; for tuberculosis, 87.1; for cerebral hemorrhage and softening, 86.4; for accidental aid unspecified external causes, 78.6, and for diabetes mellitus, 18.—*J.A.M.A.*, Jan. 7, 1928.

Misbranded Cod-Liver Oil Preparations: An extensive survey was made during 1927 by the U. S. Department of Agriculture of cod-liver oil extracts and of various products found in interstate commerce alleged to contain the vitamins of cod-liver oil. A biologic examination of these products for the presence of vitamins A and D showed that almost all the extracts and concentrates examined were practically devoid of vitamin D. Several of these articles, the department states, have been used extensively in the manufacture of so-called cod-liver oil compound tablets and other preparations. Action is to be taken to remove from interstate commerce adulterated, deteriorated or otherwise illegal extracts of cod-liver oil and of preparations falsely alleged to contain the vitamins of cod-liver oil. Statements regarding the therapeutic effects of these preparations should be limited to those that can be fully substantiated by the consensus of present-day medical opinion. The department of agriculture will continue to investigate this class of products with a view of removing from the market illegal preparations.—*J.A.M.A.*, Jan. 7, 1928.

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Association of Dental Schools, March 26-28, 1928, Washington, D. C.

American Dental Assistants Association, August 21-23, 1928, Minneapolis, Minn.

American Dental Association, August 20-24, 1928, Minneapolis, Minn.

American Dental Hygienists Association, August 20-23, 1928, Minneapolis, Minn.

American Society of Orthodontists, April 30-May 1-3, 1928, Buffalo, N. Y.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

March (1928)

Louisiana, at Shreveport (8-10).
Montana, at Missoula (29-31).

April (1928)

Alabama, at Birmingham (10-12).
California, at Stockton (9-12).
Connecticut, at New Haven (11-13).
Kentucky, at Louisville (3-5).
Maryland, at Baltimore (April 30-May 2).
Michigan, at Detroit (17-19).
New Jersey, at Asbury Park (18-21).
North Carolina, at Charlotte (16-18).
Oklahoma, at Tulsa.

May (1928)

Arkansas, at Little Rock (21-23).
Illinois, at Rock Island (8-10).
Indiana, at Indianapolis (21-23).
Iowa, at Des Moines (1-3).
Kansas, at Topeka (7-9).
Massachusetts, at Boston (7-11).
Missouri, at Kansas City (14-17).
Nebraska, at Lincoln (21-24).
New York, at Syracuse (16-18).
North Dakota, at Minot (8-10).
Pennsylvania, at Altoona (15-17).
South Carolina, at Myrtle Beach (21-23).
South Dakota, at Aberdeen (15-17).
Tennessee, at Nashville (8-11).
Vermont, at Burlington (23-25).
Virginia, at Roanoke (29-31).
West Virginia, at Parkersburg (14-16).

June (1928)

Georgia, at Atlanta (13-15).
Idaho, at Boise.
New Hampshire, at North Conway (13-15).
Southern California, at Long Beach (7-9).
Texas, at El Paso (5-7).

July (1928)

Wyoming, at Casper (9-10).

December (1928)

Ohio, at Toledo (4-6).

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Indiana, at Indianapolis, June 18, 1928. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Kentucky, at Louisville, June 8-12, 1928. Secretary, Robert L. Sprau, 968 Baxter Avenue, Louisville, Kentucky.

New Jersey, at Trenton, June 25-30, 1928. Secretary, John C. Forsyth, 148 W. State Street, Trenton, New Jersey.

ALABAMA DENTAL ASSOCIATION

The fifty-ninth annual meeting of the Alabama Dental Association will be held April 10-12, 1928, in Birmingham, instead of Mobile, as previously announced. Exhibitors desiring space, apply to

F. F. PERRY, *Secretary*,
712 Shepard Bldg.,
Montgomery, Ala.

LOUISIANA STATE DENTAL SOCIETY

The Louisiana State Dental Society will be in session at the Hotel Youree, Shreveport, March 8-10. The program is as follows:

"Office Management," by C. R. Lawrence, Enid, Okla.

"Conservation of Periodontal Tissues," by Justin D. Towner, Memphis, Tenn.

"Porcelain and Its Various Uses," by Willis A. Coston, Kansas City, Mo.

"Full Denture Construction," by F. M. High, Houston, Texas.

M. F. JARRELL, *Secretary*,
Commercial Bank Bldg.,
Alexandria, La.

NEW JERSEY STATE DENTAL SOCIETY

The fifty-eighth annual meeting of the New Jersey State Dental Society will convene in the Berkeley-Carteret Hotel, Asbury Park, April 18-21, 1928. Essays will be presented on Wednesday and Thursday, and clinics on Wednesday, Thursday and Friday. All members in good standing in the American Dental Association are invited to attend. Membership card must be shown to prove eligibility for admission to essays and clinics.

A. E. BOICE, *Chairman*,
Publicity Committee,
Broad Street Bank Bldg.,
Trenton, N. J.

TENNESSEE STATE DENTAL ASSOCIATION

The next annual meeting of the Tennessee State Dental Association will be held in Nashville, May 8-11.

JAMES B. JONES, *President*,
Murfreesboro, Tenn.

KENTUCKY STATE DENTAL ASSOCIATION

The fifty-ninth annual meeting of the Kentucky State Dental Association will be held at the Brown Hotel, Louisville, April 3-5, 1928.

FRANK B. HOWER, *Secretary*,
Francis Bldg.,
Louisville, Ky.

SOUTH DAKOTA STATE DENTAL SOCIETY

The forty-sixth annual session of the South Dakota State Dental Society will be held at Aberdeen, May 15-17, 1928. The program will consist of three half days of clinics, three half days of papers and demonstrations and one evening session. All members of the American Dental Association in good standing are welcome. Physicians, who are members of the American Medical Association and in good standing will be admitted on presentation of membership cards. Dental laboratory men vouched for by members of the state dental society will be admitted on payment of a fee of $5.00. Dental assistants will be admitted when vouched for by their employers, if the latter are members of the state dental society. School nurses and those associated with public health education work will be admitted to the health exhibits and sections devoted to public health and education. A program of motion pictures pertaining to dental health will be given on Wednesday evening and a banquet, entertainment and dance on Thursday evening. For further information, address the State Executive Convention Committee, P. O. Box 415, Aberdeen.

NORTH DAKOTA STATE DENTAL SOCIETY

The annual meeting of the North Dakota State Dental Society will be held, May 8-10, 1928, at Minot.

W. E. HOCKING,
Director of Exhibits,
Devils Lake,
N. Dak.

WISCONSIN STATE DENTAL SOCIETY

After a conference of the executive council and after getting the opinion of many members, it was decided not to present a Wisconsin State Dental Society Program this year but to use our efforts in promoting the meeting of the American Dental Association in Minneapolis.

J. W. CRAWFORD, *President*,
First National Bank Bldg.,
Milwaukee, Wis.

WYOMING STATE DENTAL ASSOCIATION

The thirteenth annual meeting of the Wyoming State Dental Association will be held at Casper, July 9-10.

E. C. ANDREW, *Secretary*,
Cheyenne, Wyo.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The fourth annual meeting of the American Dental Assistants Association will be held in Minneapolis, Minn., Aug. 21-23, 1928. General headquarters will be at the Leamington Hotel.

JULIETTE A. SOUTHARD, *President*,
174 West 96th St.,
New York City.

RUTH F. ROGERS, *General Secretary*,
Rm. 1760, 16 N. Wabash Ave.,
Chicago, Ill.

SOUTHERN ACADEMY OF PERIODONTOLOGY

The Southern Academy of Periodontology will convene for its 1928 annual meeting at Atlanta, Georgia, March 14, 1928.

Arthur H. Merritt of New York City will be the honored guest and essayist of the occasion.

CHARLES W. YOUNG, *Secretary*,
4th Nat. Bank Bldg.,
Atlanta, Ga.

THE STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

The State Board of Registration and Examinations in Dentistry of New Jersey will hold its regular examinations at Trenton, N. J., commencing June 25, 1928, and continuing for five days thereafter. The examination fee is $25.00; reexamination fee, $10.00.

Practical tests required: Insertion of an approximal gold filling, with the approximating tooth in position, compound approximal amalgam filling and a silicate filling, the candidate to furnish his own patient. Taking of impression, bite, selection of teeth, articulation and trial denture, the candidate to furnish his own patient. Practical examination in mouth diagnosis.

Attention is invited to the following quotation from the dental law of New Jersey: "Applicant shall present to said board a certificate from the Commissioner of Education of this state, showing that before entering a dental college he or she had obtained an academic education consisting of a four-year course of study in an approved high school or the equivalent thereof."

In accordance with this law, the secretary will issue application blanks only on presentation of the required certificate from the Commissioner of Education, State House, Trenton, N. J.

Application must be filed, complete, ten days before the date of examinations (June 15, 1928).

Address all communications for further particulars to

JOHN C. FORSYTH, *Secretary*,
148 West State Street,
Trenton, N. J.

AMERICAN DENTAL HYGIENISTS ASSOCIATION

The next meeting of the American Dental Hygienists Association will be held in Minneapolis, Minn., Aug. 20-23, 1928, with headquarters at the Curtis Hotel.

GLADYS I. SHAEFFER,
Chairman of Publicity,
150 East King St.,
Lancaster, Pa.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The eighth annual session of the Southwestern Society of Orthodontists will be held in Kansas City, Mo., April 26-28, 1928. A cordial invitation is extended to all dental, medical and allied professions. Immediately after the meeting, a majority of the members will leave in special cars for the meeting of the American Society of Orthodontists in Buffalo. Write to H. G. Tanzy, Commerce Bldg., Kansas City, Mo., for routing of tickets from Kansas City to Buffalo.

O. H. McCARTY, *President*,
Tulsa, Okla.

P. G. SPENCER, *Sec'y-Treas.*,
Waco, Texas.

ST. LOUIS STUDY CLUB OF DENTISTRY CLINIC AND DINNER

The St. Louis Study Club of Dentistry, organized in 1919, for the purpose of teaching advanced dental knowledge to practicing dentists, without charge, and in continuous operation since that time, has just completed its tenth annual session. The enrollment of 150 dentists for this term was the largest since the opening of the institution, which will give a clinic and dinner, Saturday, April 14, 1928, at the Gatesworth Hotel, 245 Union Boulevard.

The clinic, which will start promptly at two o'clock, will present the following subjects: dental ceramics; fixed bridgework; full dentures; operative dentistry; rizadontia; tooth form and cavity preparation; dental roentgenology; dental prophylaxis; conduction and local anesthesia; dental economics; oral diagnosis and diseases of the mouth.

After the clinic, a dinner will be given, at 6:30, as a tribute to the instructors by the students. The guest of honor on this occasion, Major John C. Gotwals, Engineering Corps, U. S. Army, will deliver a lecture on "Alaska," illustrated by motion pictures.

A cordial invitation is extended to all the members of the profession to attend this clinic and dinner.

Bulletins, descriptive of the study club, may be had by addressing Frank C. Rodgers, 309 Wall Building, St. Louis, Mo.

POSITION FOR DENTAL INTERN

The position of dental intern at the Lenox Hill Hospital will be vacant, Sept. 1, 1928. The term of service is one year, with full maintenance. Applicants must be graduates of the current year. Apply in writing not later than April 15 to

GEORGE F. SAUER, *Superintendent*,
112 East 77th St.,
New York City.

THE MORRIS L. CHAIM AND THE BENJAMIN LORD PRIZE FOR 1927

Extension of time for submission of papers

The First District Dental Society of the State of New York announces a prize of $250.00 offered by the Morris L. Chaim Fund and a prize of $150.00 offered by the Benjamin J. Lord Fund, to be known as the Morris L. Chaim Prize and the Benjamin Lord Prize respectively. These prizes are to be awarded annually at the discretion of the Board of Directors.

CONDITIONS

1. Eligibility. Membership in good standing of any bona fide dental, medical, or scientific society, or duly registered student of a recognized educational institution, prior to submission of the manuscript.

2. Date. Papers are to be submitted on or prior to June 1st, 1928, to the Secretary of the First District Dental Society, 2 East 103rd Street, New York City.

3. Papers.

A. The Morris L. Chaim Prize is offered for the most acceptable paper in the field of science and art as related to dentistry, which paper embodies the results of original research not previously published.

B. The Benjamin Lord Prize is offered for the most acceptable paper in the field of clinical dentistry having an immediate and direct value in its application to practical needs, which paper embodies the results of original research not previously published.

The manuscript shall be typewritten, and accompanied by all necessary photographs, drawings, diagrams and tables and shall be ready for publication.

The manuscript and all drawings, diagrams, photographs, tables, data, etc., shall be sealed in a plain wrapper or envelope which shall bear on the outside some symbol, group of letters, figures or other identification mark, and accompanying each such sealed packet or envelope, another sealed envelope having on the outside a duplicate of such symbol, group of letters, figures or other mark, and within this sealed envelope shall be the name and address of the person submitting the manuscript, etc.

4. Award. The award shall be made by the Board of Directors of the First District Dental Society of the State of New York. At the discretion of the Board, the prizes may be divided between the papers adjudged to be of equal merit, or both prizes awarded for one paper, if in the opinion of the judges it merits them.

5. Publication. The First District Dental Society of the State of New York will consider the publication of the successful papers, but publication by the First District Dental Society of the State of New York shall not be binding on either party.

6. Whenever and wherever published, the papers awarded the prizes shall be accompanied by the statement: "Awarded the Morris L. Chaim or the Benjamin Lord Prize, or both, in 1927, by the First District Dental Society of the State of New York."

Further information may be had by addressing: E. M. Davies, *General Secretary*, First District Dental Society, New York Academy of Medicine, 2 East 103rd Street, New York City.

RESOLUTION

Presented to the House of Delegates of the American Dental Assistants Association

WHEREAS, it has come to the attention of the Board of Trustees of the American Dental Assistants Association that accusation has been made that the organization of the American Dental Assistants Association was only a preliminary step towards the labor unionizing of dental assistants, and the ultimate control of salaries and hours of labor, and

WHEREAS, this same accusation has been made against the local and state dental assistants' societies that comprise its constituent membership, therefore, be it

Resolved, that the American Dental Assistants Association in convention assembled, at Detroit, Oct. 26, 1927, go on record as to the following:

First, that there is not a word of truth in the foregoing accusation.

Second, that the American Dental Assistants Association is a professional organization of women employed in a particular field of human service, the practice of dentistry.

Third, that the Association is endeavoring to carry on educational work among its members, for the purpose of aiding its members to render better service to the dental profession.

Fourth, that it is trying to provide training for its members that will prepare them for any emergency arising in this service.

Fifth, that its sole object is to aid its members in every way possible, to assist the dentist in rendering the highest possible service to humanity. . . Be it further

Resolved, that the foregoing be made not only a part of the records of this meeting, and of the American Dental Assistants Association, but that a copy be sent to each dental magazine for publication, and to any other person or persons as may be deemed advisable.

Signed by BOARD OF TRUSTEES.

Oct. 26, 1927.